U.S. Army Environmental Center

NO FURTHER ACTION DECISION UNDER CERCLA

STUDY AREA 31
MOORE ARMY AIRFIELD
FIRE FIGHTING TRAINING AREA

FORT DEVENS, MASSACHUSETTS

CONTRACT DAAA15-91-0008

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND

JANUARY 1995

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Prepared for:

U.S. Army Environmental Center
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Prepared by:

ABB Environmental Services, Inc.
Wakefield, Massachusetts
Project No. 6917-11

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EXECUTIVE SUMMARY

Investigations of Study Area 31 (Moore Army Airfield Fire Fighting Training Area) at Fort Devens, Massachusetts, have resulted in the decision that no further studies or remediation are required at this site. Study Area 31 was identified in the Federal Facilities Agreement between the U.S. Environmental Protection Agency and the U.S. Department of Defense as a potential site of contamination.

Fort Devens was placed on the National Priorities List under the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act on December 21, 1989. In addition, under Public Law 101-510, the Defense Base Realignment and Closure Act of 1990, Fort Devens was selected for cessation of operations and closure. In accordance with these acts, numerous studies have been conducted that address Study Area 31, including a Master Environmental Plan, an Enhanced Preliminary Assessment, and a Site Investigation (SI).

The site investigation of Study Area 31 was initiated in 1992 in conjunction with the other ten Group 3, 5 and 6 Study Areas at Fort Devens. Investigation at Study Area 31 entailed installing and sampling two monitoring wells, and drilling and sampling five soil borings. Nine other wells were installed as part of the SI to provide a group-wide water quality assessment at the airfield. To evaluate the potential impact of contaminant migration from Study Area 31, surface water and sediment samples were collected from the Nashua River.

The fire fighting training facility consists of an approximately 100-by-100-foot asphalt-covered concrete pad, surrounded by an earthen containment berm. Approximately once a year, between 1975 and 1986, an abandoned aircraft was doused with waste fuel and paint thinner and burned openly. The berm and asphalt-covered pad are still in place, but are no longer in use. During the site investigation, five soil borings were advanced within the limits of the former burn pad for the purpose of assessing potential soil contamination beneath the pad. Samples were collected from various depths and analyzed for a full suite of compounds.

Two additional soil borings for monitoring wells were drilled just outside the limits of the training area in areas presumed to be downgradient of the study

area. Groundwater was encountered at approximately 65 feet below ground surface. Two rounds of groundwater samples and water table measurements were collected from the two new monitoring wells along with the nine other monitoring wells installed during the Group 6 site investigation. Due to cross-contamination during the second sampling round a third round of groundwater samples was collected for volatile organic compounds only.

Four sets of surface water and sediment samples were collected from the Nashua River. As a means of assessing the effects of contaminated groundwater and stormwater discharging to the Nashua River, sample locations were spaced along the Nashua River both upstream and downstream of the Group 6 study areas.

The results of soil sampling and analysis showed semivolatile organic compound and petroleum hydrocarbon contamination in soils beneath the pad likely the result of releases from the fuels used in the training exercises. Concentrations were generally highest in the shallower samples suggesting limited downward migration of these contaminants. Concentrations of inorganic analytes detected in these soil samples were not significant when compared to calculated Fort Devens background. Groundwater analytical data indicated no significant organic or inorganic analyte contamination downgradient of the pad supporting the presumption that limited downward migration of fuels used in the training exercises.

Sediment sample results support the conclusion that contaminant migration via storm and surface water runoff from the airfield and other upstream sources is a likely source of sediment contamination in the Nashua River. However, due to the large number of stormwater connections, the specific source area for this contamination cannot be determined. Surface water and sediment in the Nashua River has been investigated further under Area Requiring Environmental Evaluation [AREE] 70.

On the basis of field observations, laboratory analysis, and preliminary risk evaluations at Study Area 31, there is no reason to conclude that possible hazardous waste contamination due to fire fighting training exercises has caused significant environmental contamination or poses a threat to human health or the environment. It is proposed that Study Area 31 be removed from further consideration in the Installation Restoration Program process.

1.0 INTRODUCTION

This decision document has been prepared to support a No Further Action decision at Study Area (SA) 31 - Moore Army Airfield Fire Fighting Training Area (SA 31) at Fort Devens, Massachusetts. The report was prepared as part of the U.S. Department of Defense (DoD) Base Realignment and Closure (BRAC) program to assess the nature and extent of contamination associated with site operations at Fort Devens.

In conjunction with the Army's Installation Restoration Program (IRP), Fort Devens and the U.S. Army Environmental Center (USAEC; formerly the U.S. Army Toxic and Hazardous Materials Agency) initiated a Master Environmental Plan (MEP) in 1988. The MEP consists of assessments of the environmental status of SAs, specifies necessary investigations, and provides recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. SA 31 was identified as a potential source of contamination in the MEP. On December 21, 1989, Fort Devens was placed on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act.

An Enhanced Preliminary Assessment (PA) was also performed at Fort Devens to address areas not normally included in the CERCLA process, but requiring review prior to closure. A final version of the PA report was completed in April 1992. In 1992, DoD, through USAEC, also initiated a Site Investigation (SI) of SA 31 along with the other 10 SAs in SA Groups 3, 5 and 6 at Fort Devens. The SI was conducted by ABB Environmental Services, Inc (ABB-ES).

Under Public Law 101-510, the Defense Base Realignment and Closure Act of 1990, Fort Devens has been selected for cessation of operations and closure. An important aspect of BRAC actions is to determine environmental restoration requirements before property transfer can be considered. Studies at SA 31 were conducted to support this overall mission.

2.0 BACKGROUND AND PHYSICAL SETTING

2.1 DESCRIPTION AND LAND USE

Fort Devens is located approximately 35 miles northwest of Boston, Massachusetts, adjacent to the town of Ayer and within Middlesex and Worcester Counties. The installation consists of approximately 9,280 acres and includes portions of the towns of Ayer, Harvard, Lancaster, and Shirley. Cities in the vicinity include Fitchburg, Leominster, and Lowell. Land surfaces range from about 200 feet (ft) above mean sea level (MSL) along the Nashua River in the northern portion of the installation to 450 ft above MSL in the southern portion of the installation.

Fort Devens was established in 1917 as Camp Devens, a temporary training camp for soldiers from the New England area. In 1931, the camp became a permanent installation and was redesignated as Fort Devens. Throughout its history, Fort Devens has served as a training and induction center for military personnel and a unit mobilization and demobilization site. All or portions of this function occurred during World Wars I and II, the Korean and Vietnam conflicts, and operations Desert Shield and Desert Storm.

The primary mission of Fort Devens is to command, train, and provide logistical support for non-divisional troop units as well as support various tenant activities. The installation also supports that portion of the U.S. Army Intelligence School located at Fort Devens, for the Army Readiness Region, Reserve Components, and Army Reserve and National Guard in the New England area.

Fort Devens currently consists of three major land use areas: Main Post, South Post, and North Post (Figure 2-1).

The majority of the facilities on Fort Devens are located in the Main Post area, north of Massachusetts Route 2. The Nashua River intersects the Main Post along its western edge. The Main Post provides all of the on-post housing, including over 1,700 family units and 9,800 bachelor units (barracks and unaccompanied officers' quarters). Other facilities on the Main Post include community support activities (such as a cafeteria, post exchange, commissary,

bowling alley, and golf course), administrative buildings, classrooms and training facilities, maintenance facilities, and ammunition storage facilities.

The South Post is located south of Route 2 and contains individual training areas designated for troop training, range activities, and a drop zone. The Nashua River bounds the South Post on the northeast side.

The North Post abuts the main post to the north of West Main Street in Ayer. The principal activities on the North Post are the installation Waste Water Treatment Plant and the Douglas E. Moore Army Airfield (MAAF), where SA 31 is located.

2.2 REGIONAL GEOLOGY

Fort Devens is near the western boundary of the Seaboard Lowland Section of the New England-Maritime Physiographic province (Jahns, 1953). It is adjacent to the Worcester County Plateau of the Central Uplands province and part of the installation lies within the province (Koteff, 1966). The land surface is almost completely covered with unconsolidated glacial outwash deposits, resulting in few bedrock outcrops. The surficial deposits are underlain by a highly complex assemblage of intensely folded and faulted metasedimentary rocks with occasional igneous intrusions. The geomorphology of the region is dominated by glacial features such as outwash plains, kames, kame terraces, drumlins, and eskers.

2.3 REGIONAL HYDROGEOLOGY

Groundwater at Fort Devens occurs largely in the permeable glacial-deltaic outwash deposits of sand, gravel, and boulders. Well yields within these sediments are dependent upon the hydraulic characteristics of the aquifer and can range from 2 to more than 300 gallons per minute (gpm). Small amounts of groundwater can be obtained from fractured bedrock with yields ranging from 2 to 10 gpm. Minor amounts of groundwater may be found in thin, permeable glacial lenses elsewhere on the installation. The primary hydrogeologic feature at Fort Devens is the Nashua River, which flows through the installation in a south-to-north direction with an average discharge rate of 55 cubic feet per second. In addition to the Nashua River, the terrain is dissected by numerous brooks that are

associated with attendant wetlands. There are also several kettle ponds and one kettle lake located within the installation.

2.4 STUDY AREA DESCRIPTION AND HISTORY

SA 31 is a former fire fighting training area located at the western end of the abandoned east-west runway at the airfield, which occupies a large, comparatively flat kame plain that is elevated 40 to 50 ft above the surrounding land surface (Figure 2-2). The fire fighting training facility consists of an approximately 100-by-100-foot asphalt-covered concrete pad, surrounded by an earthen containment berm 12 inches high and 24 inches wide. Approximately once a year, between 1975 and 1986, an abandoned aircraft was doused with contaminated fuel and paint thinner and was burned openly (Biang et al., 1992; McMaster et al., 1982; and Reynolds, personal communication, 1991). The facility is no longer in use, and no abandoned aircraft remain. The berm and asphalt-covered pad are still in place, with sparse vegetative cover.

The area occupied by SA 31 is expected to remain as part of the airfield in the foreseeable future.

3.0 RELATED INVESTIGATIONS

3.1 MASTER ENVIRONMENTAL PLAN

Based in part on information reported by McMaster et al. (1982), the MAAF fire-fighting training area was identified in the MEP (Biang et al., 1992) as a possible source for release of contaminants into the environment. The MEP recommended collection of soil samples for laboratory analysis of Target Compound List (TCL) compounds, toxicity characteristics, and total petroleum hydrocarbon compounds (TPHCs), as well as the installation of monitoring wells and laboratory analysis of groundwater samples for TCL compounds and TPHC.

3.2 ENHANCED PRELIMINARY ASSESSMENT

The PA (Mellon et al., 1992) included a review of the study and recommendations presented in the MEP and consideration of other areas that might require evaluation due to the closure of Fort Devens. The PA cited a study by Gates et al. (1986, p. 3-43) which noted that the fuels were ignited and burned after short contact time, that very little product was observed on the pad after a fire was extinguished, and that the potential for migration was very low. However, Mellon et al. (1992) concluded that some potential for migration remains.

No additional recommendations for SA 31 were provided in the PA.

3.3 SITE INVESTIGATION REPORT

The SI was initiated in June 1992 and included 11 of the Group 3, 5 and 6 SAs listed in the MEP.

- SA 38 (Building 3713/Battery Repair Area)
- SA 44 (Cannibalization Yard)
- SA 52 (TDA Maintenance Yard)
- SA 9 (North Post Landfill)
- SA 19 (Wastewater Treatment Plant)
- SA 20 (Rapid Infiltration Sand Beds)

- SA 21 (Sludge Drying Beds)
- SA 30 (Moore Army Airfield Drum Storage Area)
- **SA 31 (Moore Army Airfield Fire-Fighting Training Area)**
- SA 47 (Moore Army Airfield Underground Storage Tank Site)
- SA 50 (Moore Army Airfield World War II Fuel Point)

The SI was conducted by ABB-ES under contract with USAEC. The Final SI Report was issued April 1993. The purpose of the SI was to verify the presence or absence of environmental contamination and to determine whether further investigation or remediation was warranted.

The investigation specific to SA 31 focused on identifying potential migration of unburned fuels into the subsurface resulting in soil contamination and possibly groundwater contamination.

Because of the proximity of all four of the MAAF SAs, the groundwater beneath the airfield was investigated on a group-wide basis. Groundwater monitoring well locations were selected to provide both local coverage of SA-specific conditions and collectively to provide group-wide coverage of water-table elevations, groundwater flow directions, and aquifer conductivities. Eleven monitoring wells (G6M-92-01X through G6M-92-11X) were installed in boring locations throughout Group 6. Wells G6M-92-04X and G6M-92-05X were specifically installed at locations inferred to be downgradient of SA 31. Water levels measured in the newly installed wells indicated that groundwater beneath SA 31 flows generally westward and southwestward toward the Nashua River (Figure 3-1). The river appears to have a dominant influence on groundwater flow in the area, and the influence of the kame plain landform is negligible. Monitoring wells G6M-92-04X and G6M-92-05X were installed at the water table near SA 31. The groundwater depth in those wells is approximately 65 ft bgs.

Two rounds of groundwater samples, conducted three months apart, were collected from the monitoring wells. The samples were analyzed for project analyte list (PAL) VOCs, PAL semivolatile organic compounds (SVOCs), PAL inorganics, PAL anions/cations, total suspended solids (TSS), and total petroleum hydrocarbons (TPHC). Due to the cross-contamination issue detailed in the Final SI Report (ABB-ES, 1993), a third round of groundwater samples was collected and analyzed for PAL VOCs.

The soil borings for monitoring wells G6M-92-04X and G6M-92-05X were drilled to 10 ft below the observed water table (to depths of 72 and 70 ft below ground surface [bgs], respectively), and split-spoon soil samples were collected at 5-foot intervals for field classification and field-screening by photoionization detector (PID) for total volatile organic compounds (VOCs). The soils consisted generally of sands and gravelly sands. Bedrock was not encountered in the Group 6 SIs.

Five soil borings were drilled through the asphalt/concrete pad to evaluate subsurface soil conditions (Figure 3-2). Borings 31B-92-01X through 31B-92-04X were drilled at the corners to depth 10 ft bgs and were sampled continuously. Three samples from each of those four borings were selected for laboratory analysis. Boring 31B-92-05X was drilled in the center of the pad to depth 62 ft bgs (the observed depth of the water table) and was sampled at 5-foot intervals. Five samples from boring 31B-92-05X were selected for laboratory analysis. All soil samples were field classified and were field-screened for total VOCs using a PID. The selected soil samples were analyzed in the laboratory for PAL VOCs, PAL SVOCs, PAL inorganics, and TPHC.

3.4 PRELIMINARY RISK EVALUATION

Preliminary Risk Evaluations (PREs) were performed as part of the SI to help establish whether environmental contamination at SA 31 required further investigation or remediation. This section presents the general approach employed for the SI PREs. Details of the human health and ecological PREs for SA 31 are presented in Sections 5.0, and 6.0, respectively.

As presented in Section 3.3, environmental investigations at SA 31 entailed sampling and analysis of the following environmental media:

- Groundwater
- Soil
- Surface Water and Sediment

Because analytes detected in the Nashua River surface water and sediment are not derived specifically from the Groups 6 SAs, the Army and regulatory authorities have agreed previously that surface water and sediment from this water body will be evaluated in a separate study (Area Requiring Environmental

Evaluation [AREE] 70). The AREE 70 report concluded that, among other findings, due to the limited nature and extent of the contamination detected in the northern section of the Nashua River, no further action is recommended. Therefore, Nashua River contamination was not considered in SA 31 PREs.

3.4.1 Human Health Risk Evaluation

The Human Health PRE at SA 31 included the following elements:

- **Current and Future Land Use**: Current and foreseeable future land uses are particularly relevant with respect to the applicability of soil screening values used in the PRE. Two sets of soil screening values were used in the evaluation (USEPA, 1993). One set, U.S. Environmental Protection Agency (USEPA) Region III risk-based concentrations for residential soil, was used when the current and/or foreseeable future land use is residential. The other set, USEPA Region III risk-based concentrations for commercial/industrial soil, was used when the current and/or foreseeable future land use is commercial or industrial.

- **Comparison to Public Health Standards and Guidelines**: For soil and groundwater, human health standards and/or guidelines were used as screening criteria to evaluate the significance of the sampling data. To evaluate the concentrations of compounds detected in groundwater, federal and Massachusetts drinking water standards and guidelines were used. The USEPA's Region III risk-based concentrations were used to evaluate the results of the soil sampling program. The basis and applicability of these standards and guidelines are discussed below.

  USEPA Drinking Water Regulations. Federal drinking water standards (both final and proposed) were used to evaluate the significance of the groundwater sampling data. These standards were extracted at the time of the SI from the USEPA Office of Water's "Drinking Water Regulations and Health Advisories", November 1992.

  Massachusetts Drinking Water Standards and Guidelines. For some compounds, MADEP has promulgated drinking water standards that are more stringent than the federal drinking water standards. MADEP has

also developed drinking water guidelines for compounds for which no federal standards exist.

OSWER Lead Guidance (OSWER Directive: 9355.4-02). USEPA has set forth an interim soil cleanup level for total lead which is protective for direct contact exposure at residential settings. The interim guidance was published in September 1988. Further guidance will be developed after the USEPA has developed a verified Cancer Potency Factor and/or a Reference Dose for lead.

USEPA Region III Risk-Based Concentration Table. This table is used by USEPA Region III toxicologists as a risk-based screening tool for Superfund sites, a benchmark for evaluating preliminary SI data, and preliminary remediation goals. Although it has no official status either as regulation or guidance, it is useful as a screening tool. The table is updated quarterly and therefore regularly incorporates new USEPA toxicity constants as they are developed. During the production of the SI Report (ABB-ES, 1993), the First Quarter 1993 update (USEPA, 1993) was used in the PRE.

For the SA 31 Human Health PRE, Region III risk-based concentrations for tap water and residential soil were used. Risk-based concentrations for tap water assume daily consumption of two liters of water for a residential lifetime of 30 years; these also assume exposure from the inhalation of volatiles from household water uses (including showering, laundering, and dish washing). Risk-based concentrations for residential soil assume that an individual ingests soil 350 days per year for a residential lifetime of 30 years, at an age-adjusted ingestion rate of 100 milligrams per day (mg/day).

Following the Region III approach, ABB-ES developed screening values for petroleum products in soil. To evaluate the health risks associated with petroleum products measured as TPHC in soil, ABB-ES developed risk-based concentrations. These concentrations were calculated using the same exposure assumptions as those used by USEPA toxicologists in the USEPA Region III Risk-Based Concentration Table, First Quarter, 1993 for commercial/industrial soils and residential soils. For SA 31, JP-4 (a jet

fuel) was selected as the type of fuel oil most likely used in fire training exercises.

3.4.2 Ecological Risk Evaluation

Because SA 31 is a paved site, no significant habitat for resident or migratory ecological receptors occurs at this site. A review of the Fort Devens biological database indicates that no rare or endangered species are known to occur in the vicinity of SA 31. Therefore, based on the lack of ecological habitat at SA 31, and the resulting lack of ecological exposure pathways, no comparison of surface soil analytes to PCL reference values was conducted.

4.0 CONTAMINATION ASSESSMENT

The SA 31 SI analytical results are discussed by medium in the following subsections.

4.1 SOILS

The soils at SA 31 are high-conductivity sands with no significant or continuous stratification and no observed layers of silt or clay. A total of 17 soil samples were collected for laboratory analysis from the five borings advanced through the asphalt pad at SA 31. The samples were analyzed for organics, inorganics, and TPHC. The laboratory results for organic compounds are provided in Table 4-1. Figures 4-1, 4-2, and 4-3 show the distribution of total VOCs, total SVOCs, and TPHC in soils collected at three depth intervals from 0 to 10 ft.

Toluene was observed at a concentration of 0.0019 micrograms per gram (μg/g) in the soil sample collected from immediately beneath the concrete in 31B-92-03X. Toluene was also detected, at a greater concentration, in the soil method blank and, therefore, is likely attributable to laboratory contamination (ABB-ES, 1993, Appendix F). No other VOCs were detected in any of the other soil samples collected. SVOCs, mostly polynuclear aromatic hydrocarbons (PAHs), were detected in almost all soil samples collected except those collected from 31B-92-03X and the deep samples (30 ft and below) collected from 31B-92-05X. Borings 31B-92-01X and 31B-92-02X exhibited the highest concentrations of PAHs between 2 and 4 ft and 4 and 6 ft, respectively. TPHC concentrations generally mirrored the distribution of the SVOCs except in 31B-92-05X, where low concentrations of TPHC were detected at depth. SVOCs are not present at depth in 31B-92-05X. The highest TPHC concentration was 2,090 μg/g detected in the 8-foot depth sample from boring 31B-92-04X. No other significant lateral or vertical distribution of these analytes was found.

The soil samples were collected from beneath the pad, particularly in boring 31B-92-05X, along the probable contaminant migration path and are representative of the potential "worst case" soil conditions at SA 31. Any potential contaminant migration is expected to have been vertically downward to the water table from releases through the pad, because no significant stratification of silt and clay in the soil column was observed. The concentrations of TPHC in soil at depth

beneath the pad (40 μg/g at 30 ft bgs and 35.1 μg/g at 60 ft bgs) represent concentrations just above the detection limit for TPHC (roughly 28 to 29 μg/g) and are considered low. Because TPHC was not detected at 45 ft bgs, no continuous connection between surface contamination and TPHC detected at depth was observed. Further, no associated VOCs or SVOCs were observed in the samples exhibiting TPHC contamination below 20 ft bgs.

With the exception of beryllium, calcium, copper, and sodium, no significant concentrations of inorganic analytes were detected above calculated Fort Devens background concentrations (Table 4-2). Concentrations of beryllium ranged from 0.572 to 0.608 μg/g in the three samples in which it was detected (borings 31B-92-02X, 31B-92-03X, and 31B-92-05X). These naturally occurring beryllium concentrations are only marginally greater than the analytical method detection limit and the Fort Devens background concentration. Similarly, calcium was detected above the background soil concentration in three samples in three separate borings. Sodium was detected in nine of the 17 samples collected with concentrations ranging from 112 to 172 μg/g. Elevation sodium and calcium concentrations are likely the result of runway deicing. Copper was detected just above the background concentration in the surface soil sample collected from 31B-92-05X and is likely representative of natural background. No apparent lateral or vertical distribution of these inorganic analytes is evident. Figures 4-4, 4-5, and 4-6 show the distribution at each depth interval of inorganic analytes exceeding calculated background concentrations for typical Fort Devens soils.

4.2 GROUNDWATER

Eleven groundwater monitoring wells were installed and sampled as part of the SA Group 6 groundwater quality assessment. Analytical results are provided in Tables 4-3 and 4-4. Two of these wells, G6M-92-04X and G6M-92-05X, were specifically installed to assess groundwater impacts due to fire-fighting training activities. bis(2-ethylhexyl)phthalate (B2EHP) was detected in groundwater samples collected from these wells during both rounds of sampling. B2EHP is considered a laboratory contaminant because in most instances the detected concentration was the same order of magnitude as the detected concentration in a water method blank sample (see Section 4.4). A low concentration of TPHC (1.06 milligrams per liter [mg/l]) was detected in the Round 2 sample collected from G6M-92-05X. The absence of an ungradient source, low concentration, and

inconsistency between sampling rounds makes the detection of TPHC in groundwater speculative. No VOCs were detected in either the Round 1 or Round 3 samples collected from the two wells. Calcium, copper, lead, manganese, and zinc were all detected at concentrations above the calculated background concentrations in unfiltered groundwater samples collected at G6M-92-04X during both sampling rounds. The filtered sample collected from G6M-92-04X in Round 2 showed elevated calcium only. The elevated concentrations detected in unfiltered samples are likely caused by the high TSS concentration recorded for the sample. After filtering, only the more soluble inorganic analytes (calcium) was detected above background supporting the contention that the other inorganic analytes are suspended solids (undissolved) in groundwater. The elevated calcium concentration is likely the result of runway deicing. No inorganic analytes were detected above background in G6M-92-05X groundwater except for zinc in Round 2. Analytical results for groundwater are shown in Figure 4-7.

4.3 SURFACE WATER AND SEDIMENT

The four surface water samples collected for Group 6 were analyzed for organic and inorganic analytes, TPHC, water quality parameters, and TSS. Analytical results for surface water and sediment samples are provided in Tables 4-5 and 4-6, respectively.

No organic compounds were found above detection limits in any surface water samples; nine of the 23 inorganic analytes were detected (arsenic, barium, calcium iron, lead, magnesium, manganese, potassium, and sodium). Both total and fecal bacteria counts decreased downstream in the SA Group 6 surface water samples. Figure 4-8 shows the distribution of contaminants detected in SA Group 6 surface water samples.

Detected organic compounds in Nashua River sediments included acetone, toluene, three PAHs, B2EHP, and TPHC. Both toluene and B2EHP are likely laboratory contaminants, as these compounds were detected at similar concentrations in soil method blank samples. Acetone is also a suspected laboratory contaminant as it was detected in a soil method blank samples but at a lower concentration (see Section 4.4). TPHC concentrations were highest in the upstream sample. Nearly all of the inorganic analytes tested were detected in

sediment samples. The distributions of organic compounds, TPHC, and selected inorganic analytes are provided in Figures 4-9, 4-10, and 4-11.

4.4 QUALITY CONTROL BLANKS

The quality control blanks analyzed during the Groups 3, 5 and 6 SI included method blanks, trip blanks, and rinsate blanks. Method blanks were analyzed to determine if compound analytes were introduced at the laboratory. Data were generated by Environmental Science and Engineering, Inc. (ESE) laboratories from soil and water samples collected from May through July 1992.

Method blanks were analyzed for organic contaminants and used as quality control samples for the evaluation of SA 31 analytical samples. Chemically pure deionized water was used to prepare method blanks at the laboratory. The blanks were run as if they were actual field samples using methods LM19 and UM20 for VOCs in soil and water, respectively; and methods LM18 and UM18 for SVOCs in soil and water, respectively. Any detected compounds were considered to be the result of laboratory contamination, because water used in the preparation of the blanks was contaminant free. Because method blanks were prepared and analyzed periodically throughout the Groups 3, 5 and 6 SI sample analysis program, there is no logical way to assign individual blanks to any specific group. Therefore, the results for method blank contamination are applied globally for all of SA Groups 3, 5 and 6. The following data is a presentation of all organic compounds detected above detection limits in the SA Groups 3, 5 and 6 method blanks and the frequency at which they were found.

Water method blanks contained the following PAL organic compounds: B2EHP (two of two samples at 6.6 micrograms per liter [μg/l]), toluene (four of 36 samples at 0.5 to 0.51 μg/l), chloroform (16 of 36 samples at 0.5 to 1.3 μg/l), TCA (six of 36 samples at 1.1 to 2.5 μg/l).

Soil method blanks contained the following PAL organic compounds: toluene (two of two samples at 0.2 μg/g), B2EHP (two of 26 samples at 1.1 μg/g), acetone (two of 48 samples at 0.036 μg/g), trichlorofluoromethane (TCFM) (four of 48 samples at 0.008 μg/g), and chloroform (two of 48 samples at 0.002 μg/g).

B2EHP, detected in laboratory blanks, is listed in the USEPA Statement of Work (SOW) as a common laboratory contaminant and when detected in sample results at similar concentrations is probably representative of laboratory contamination. Other SVOCs detected in soil and water method blanks were 1,2-epoxycyclohexene, mesityl oxide, and several unknown compounds. These non-target compounds should also be considered as laboratory contaminants when seen in sample data at similar concentrations.

Toluene, acetone, TCFM, chloroform and one unknown compound were detected in the soil method blanks. Toluene, acetone and chloroform are defined as common laboratory contaminants in the USEPA SOW. TCFM, although not included in this list, is also used frequently as a solvent in laboratories. These compounds can be considered as laboratory introductions when observed in similar concentrations to those in the method blank data.

TCA, toluene, and chloroform were reported in the water method blanks. As stated previously, toluene and chloroform are common laboratory contaminants. Their presence in similar concentrations as sample results should be attributed to this introduction rather than site contamination. The presence of TCA has also been attributed to laboratory contamination per conversations with ESE laboratory personnel. The problem was persistent for several months.

5.0 PRELIMINARY HUMAN HEALTH RISK EVALUATION

The future use of SA 31 is expected to be industrial/commercial. Tables 5-1, 5-2, and 5-3 present summary statistics and human health standards and guidelines used in the PRE for SA 31. Average values presented in the following discussions reflect the average of detected concentrations only.

5.1 SOILS

This preliminary risk evaluation considered all soils to a depth of 3 ft as accessible under a residential future use exposure scenario. This approach is conservative (i.e., health-protective) because the most likely future use of SA 31 is industrial/commercial. All subsurface soil (defined as 3 to 10 ft in depth) was considered as accessible under a commercial/industrial future use exposure scenario.

5.1.1 Surface Soils

Table 5-1 presents summary statistics on surface soil at SA 31 and USEPA Region III residential soil concentrations for comparison. Surface soil at SA 31 is represented by samples collected 31B-92-01X to 31B-92-05X between 0 and 3 ft.

An assessment of the inorganic data for SA 31 surface soils shows that there is no apparent gross contamination present. As shown in Table 5-1, the maximum detected concentrations of only two compounds, beryllium and copper, slightly exceeded the statistical background. However, the maximum concentration of copper is well below the USEPA Region III residential soil concentration. The maximum concentration of beryllium (0.57 μg/g) only slightly exceeds the residential soil concentration of 0.4 μg/g and is below the more applicable commercial/industrial soil concentration of 0.67 μg/g. Although arsenic was detected at a maximum concentration (8.8 μg/g) above the residential soil concentration (0.97 μg/g), its average and maximum detected concentrations are well below the statistical background.

Of the 17 organic analytes reported in Table 5-1, only one (benzo[a]pyrene) was detected at a concentration (average: 0.47 μg/g; maximum 0.62 μg/g) slightly above the USEPA Region III residential soil concentration (0.23 μg/g).

5.1.2 Subsurface Soils

Table 5-2 presents summary statistics on subsurface soil at SA 31 and USEPA Region III commercial/industrial soil concentrations for comparison. Subsurface soil at SA 31 is represented by samples collected from borings 31B-92-01X to 31B-92-05X between 3 and 15 ft below grade.

The maximum detected concentration of only one inorganic analyte (arsenic) in Table 5-2 exceeds the USEPA Region III commercial/industrial concentration. However, arsenic was detected at levels (average: 7.8 μg/g; maximum 10 μg/g) well below the statistical background (21.1 μg/g).

Only two detected organic analytes (benzo[a]anthracene and benzo[b]fluoranthene) are present at concentrations above the USEPA Region III commercial/industrial concentrations. Both PAHs were detected in only one of nine samples. The single detection of benzo(a)anthracene (3 μg/g) only slightly exceeds the commercial/industrial concentration of 2.7 μg/g. The single detection of benzo(b)fluoranthene (4 μg/g) only slightly exceeds the commercial/industrial soil concentration of 3.2 μg/g.

TPHC was also detected in SA 31 subsurface soil at an average and maximum detected concentration of 318 and 2,090 μg/g, respectively. To evaluate the health risk associated with TPHC in soil, ABB-ES developed risk-based concentrations for petroleum products. These concentrations were calculated using the same exposure assumptions as those used by USEPA toxicologists in the USEPA Region III Risk-Based Concentration Table, First Quarter, 1993, for commercial/industrial soils and residential oils. For SA 31, JP-4 (a jet fuel) is the type of fuel oil most likely used in fire training exercises. The dose/response value used for JP-4 is a provisional value developed by USEPA, Environmental Criteria and Assessment Office (USEPA, 1992). The following are the risk-based concentrations for JP-4:

Analyte	Residential Soil (μg/g)	Commercial/Industrial Soil (μg/g)
JP-4	630	8180

The maximum detected TPHC concentration of 2,090 μg/g is above the residential soil concentration of 630 μg/g, but is well below the more applicable

commercial/industrial soil concentration of 8,180 μg/g. The average detected concentration of TPHC (318 μg/g) is well below both the residential and commercial/industrial soil concentrations.

5.1.3 Groundwater

Table 5-3 presents summary statistics on groundwater at SA 31 and drinking water standards for comparison. Monitoring well locations G6M-92-04X and 05X have been used to define the groundwater quality in the vicinity of the former fire-fighting training area. Except for TPHC in groundwater (not likely associated with SA 31), organic contaminants in soils at the subject areas have not been detected in groundwater during the SI. B2EHP was detected in samples collected from both monitoring wells at concentrations in excess of the USEPA Region III tap water concentration. However, B2EHP is suspected of being a laboratory contaminant and the concentrations detected in these samples are not likely representative of true groundwater contamination. Only the federal secondary standard for aluminum and manganese of 50 μg/l was exceeded at monitoring well location G6M-92-04X. When compared to Round 2 filtered results, it is likely that these elevated concentrations are the result of elevated TSS in the samples.

6.0 PRELIMINARY ECOLOGICAL RISK EVALUATION

Mowed grass surrounds the 100-by-100-foot asphalt-covered region that is defined as SA 31. Several weedy species characteristic of old field habitat occur around the perimeter of SA 31, including Queen Anne's lace (*Daucus carota*), evening primrose (*Oenothera biennis*), goldenrods (*Solidago* spp.), asters (*Aster* spp.), shepherd's purse (*Capsella bursa-pastoris*), ragweed (*Ambrosia artemisiifolia*), and upland grasses.

Because SA 31 is a paved site, no significant habitat for resident or migratory ecological receptors occurs at this site. A review of the Fort Devens biological database indicates that no rare or endangered species are known to occur in the vicinity of SA 31. Therefore, based on the lack of ecological habitat at SA 31, and the resulting lack of ecological exposure pathways, no comparison of surface soil analytes to PCL reference values was conducted.

7.0 CONCLUSIONS

No further action is recommended for SA 31. This recommendation is based on an evaluation of the historical information on the use of SA 31 as confirmed by physical observations, sampling, and chemical analysis results. It is also based on the results of a preliminary risk evaluation.

The contaminant profile established during the SI is consistent with the reported historical use of the fire fighting training area and with observations made during the installation of soil borings. Sampling and analysis during the SA 31 SI indicated that contaminants detected were likely derived from petroleum hydrocarbon fuels. Chlorinated solvents were not detected. The distribution of these contaminants suggests that downward migration has occurred, but is limited in extent. It is unlikely that the detected soil contaminants from SA 31 activities have or will have significantly affect groundwater quality. Groundwater was detected at 62 feet below ground surface. The concentrations of TPHC in soil at depth beneath the pad were just above detection limits. These concentrations are very low (just above the detection limit) and not a significant source of groundwater contamination. Because TPHC was not detected in soil at 45 feet, no continuous connection between the surface contamination and groundwater is evident (Figure 7-1). Additionally, TPHC was not detected in either round of groundwater collected directly downgradient from the pad.

The human health PRE identified two organic compounds (benzo[b]fluoranthene and benzo[a]anthracene) and one inorganic analyte (beryllium) in surface and subsurface soil as possible human health threats. The beryllium is likely naturally occurring and not representative of contamination from SA 31. The infrequent detection of benzo(b)fluoranthene and benzo(a)anthracene with the limited exposure potential (paved) suggests that they pose no significant threat to human health. Further, the limited habitat and lack of exposure pathways identified in the ecological PRE suggests no threat to the environment exists at SA 31. Thus no unacceptable threats to human health or the environment due to hazardous waste contamination were identified at SA 31.

8.0 DECISION

On the basis of findings at SA 31, there is no evidence or reason to conclude that the historical use of SA 31 for fire fighting training exercises has caused significant environmental contamination or poses a threat to human health or the environment. The decision has been made to remove SA 31 from further consideration in the IRP process. In accordance with CERCLA 120 (h) (3), all remedial actions necessary have taken place, and the USEPA and MADEP signatures constitute concurrence n accordance with the same.

James C. Chambers

JAMES C. CHAMBERS
BRAC Environmental Coordinator

18 JAN 95
Date

U.S. ENVIRONMENTAL PROTECTION AGENCY

James P. Byrne

JAMES P. BYRNE
Fort Devens Remedial Project Manager

1/18/95
Date

[X] Concur

[ ] Non-concur (Please provide reasons for non-concurrence in writing)

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

D. Lynne Welsh

D. LYNNE WELSH
Section Chief, Federal Facilities - CERO

1/18/95
Date

[X] Concur

[ ] Non-concur (Please provide reasons for non-concurrence in writing)

ABB-ES	ABB Environmental Services, Inc.
AREE	Area Requiring Environmental Evaluation
B2EHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BRAC	Defense Base Realignment and Closure Act of 1990
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DoD	U.S. Department of Defense
ESE	Environmental Science and Engineering, Inc.
ft	foot or feet
gpm	gallons per minute
IRP	Installation Restoration Program
MAAF	Moore Army Airfield
MEP	Master Environmental Plan
mg/day	milligrams per day
mg/l	milligrams per liter
MSL	mean sea level
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PAL	Project Analyte List
PCL	protective contaminant level
PID	photoionization detector
PRE	Preliminary Risk Evaluation
SA	study area
SI	site investigation
SOW	Statement of Work
SVOC	semivolatile organic compounds

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TCFM	trichlorofluoromethane
TCL	target compound list
TPHC	total petroleum hydrocarbon compound
TSS	total suspended solids
μg/g	micrograms per gram
μg/l	micrograms per liter
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

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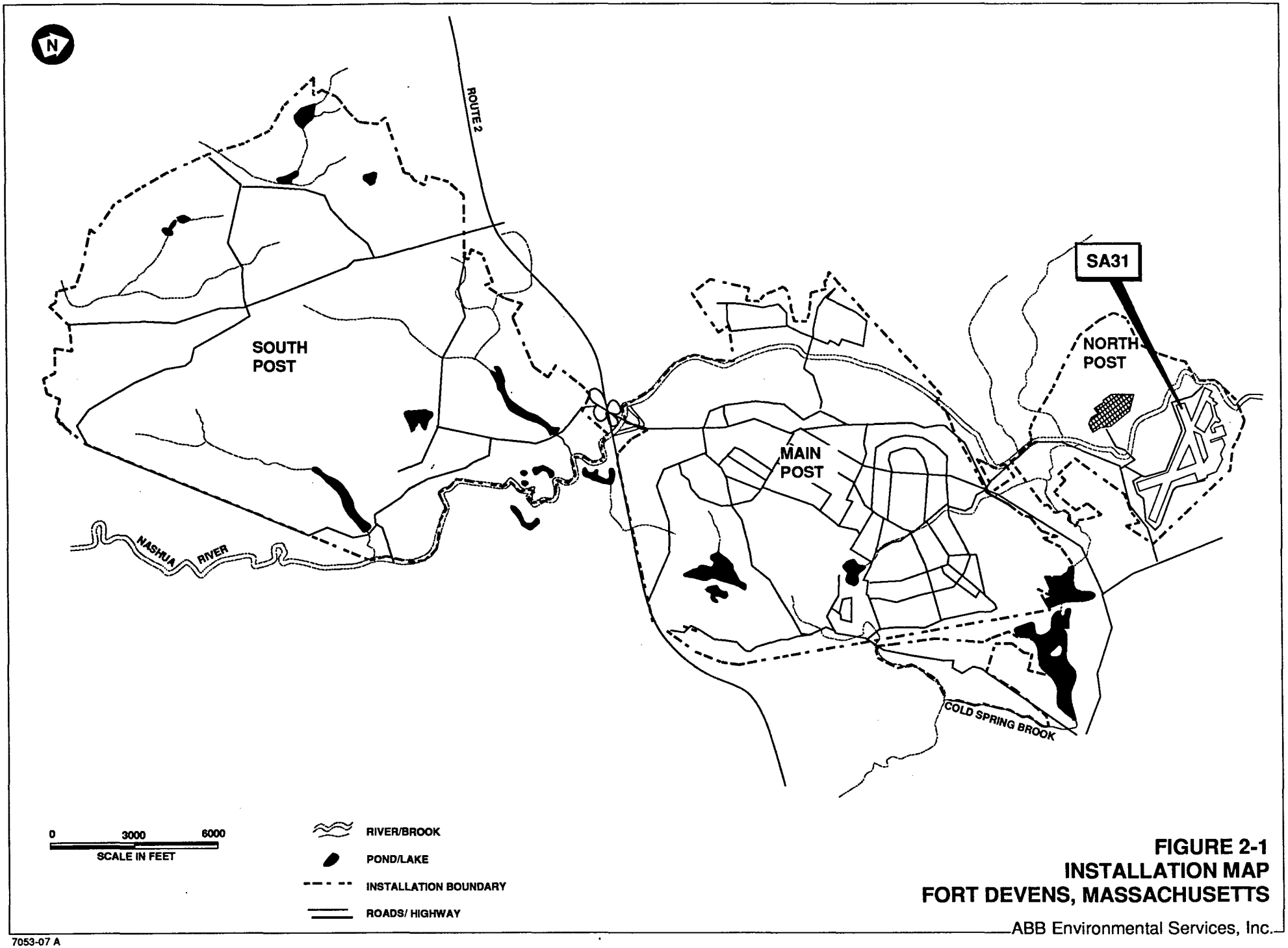

FIGURE 2-1
INSTALLATION MAP
FORT DEVENS, MASSACHUSETTS

ABB Environmental Services, Inc.

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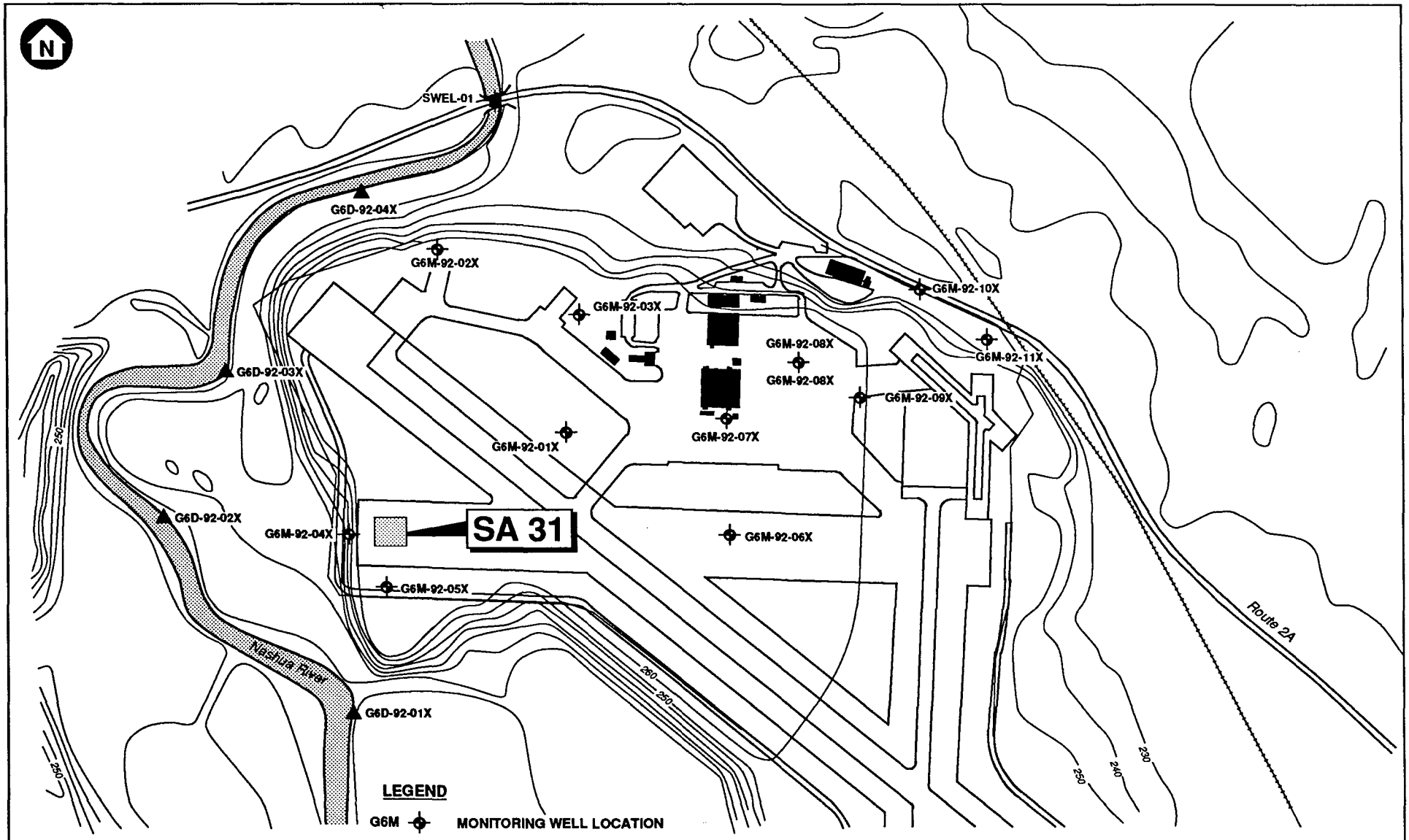

FIGURE 2-2
LOCATION OF SA 31
GROUP 6 STUDY AREAS
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(a)-123 5

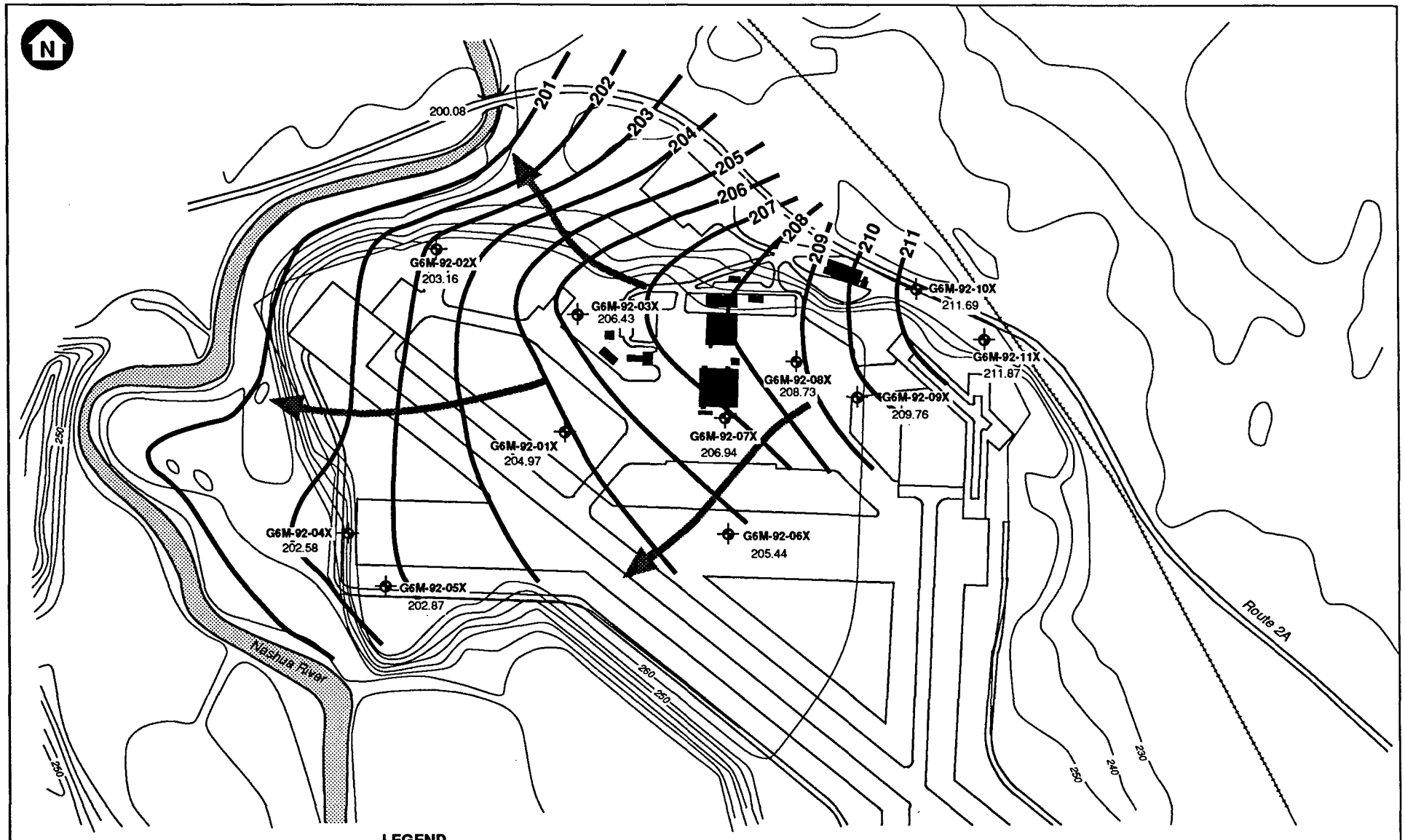

FIGURE 3-1
GROUNDWATER LEVELS AND INFERRED FLOW DIRECTIONS GROUP 6 STUDY AREAS FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(a) 3 67

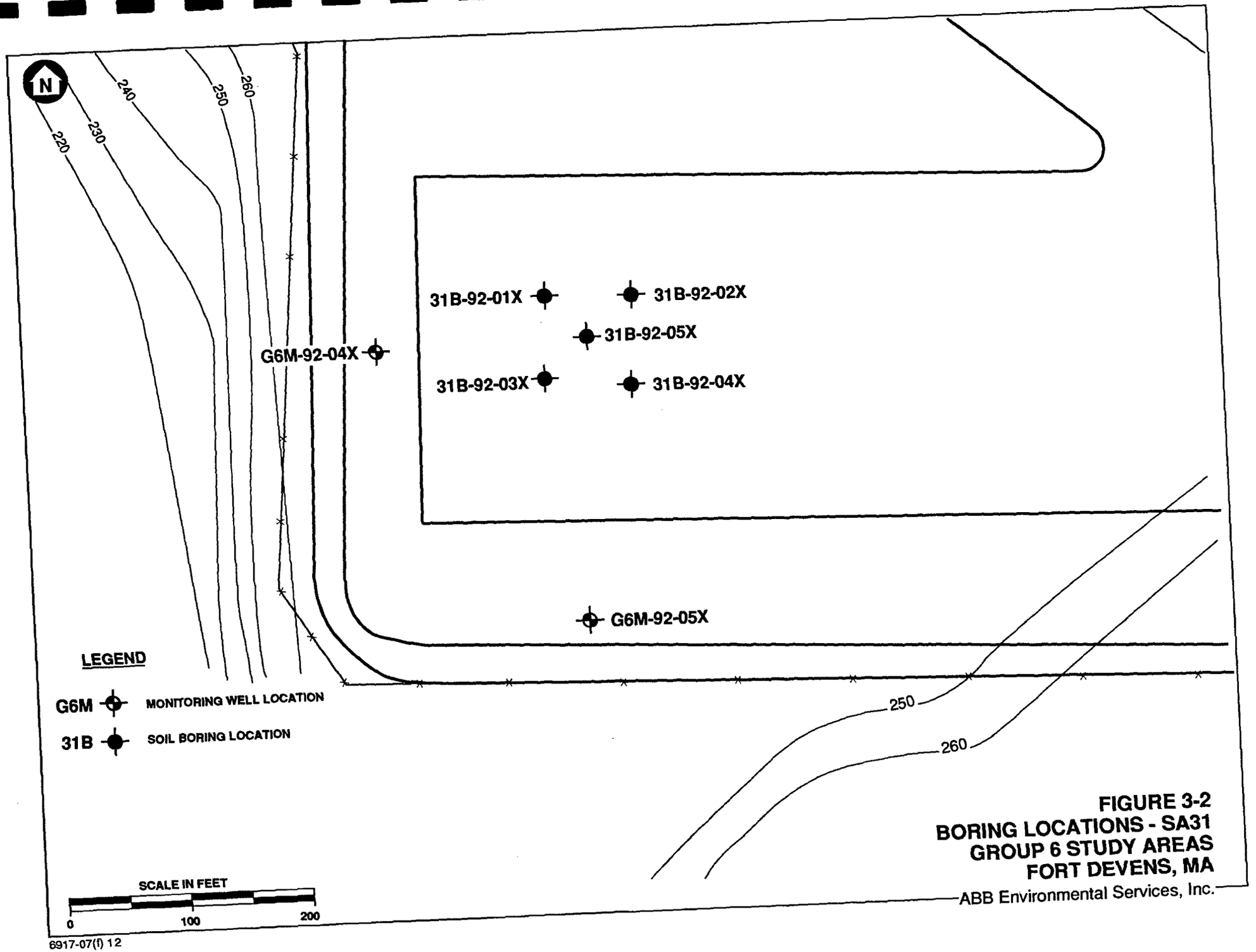

FIGURE 3-2
BORING LOCATIONS - SA31
GROUP 6 STUDY AREAS
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(f) 12

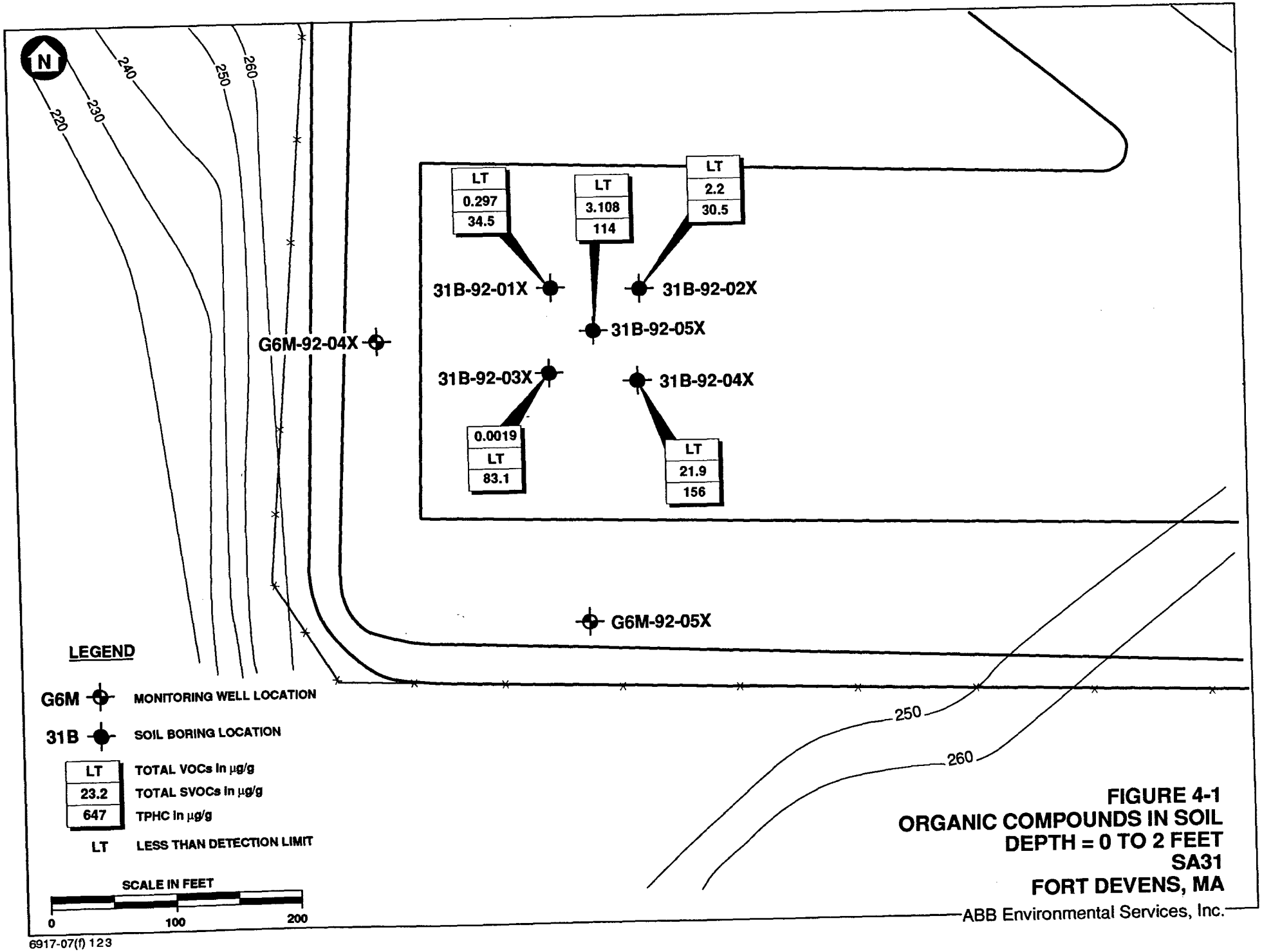

FIGURE 4-1
ORGANIC COMPOUNDS IN SOIL
DEPTH = 0 TO 2 FEET
SA31
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(f) 123

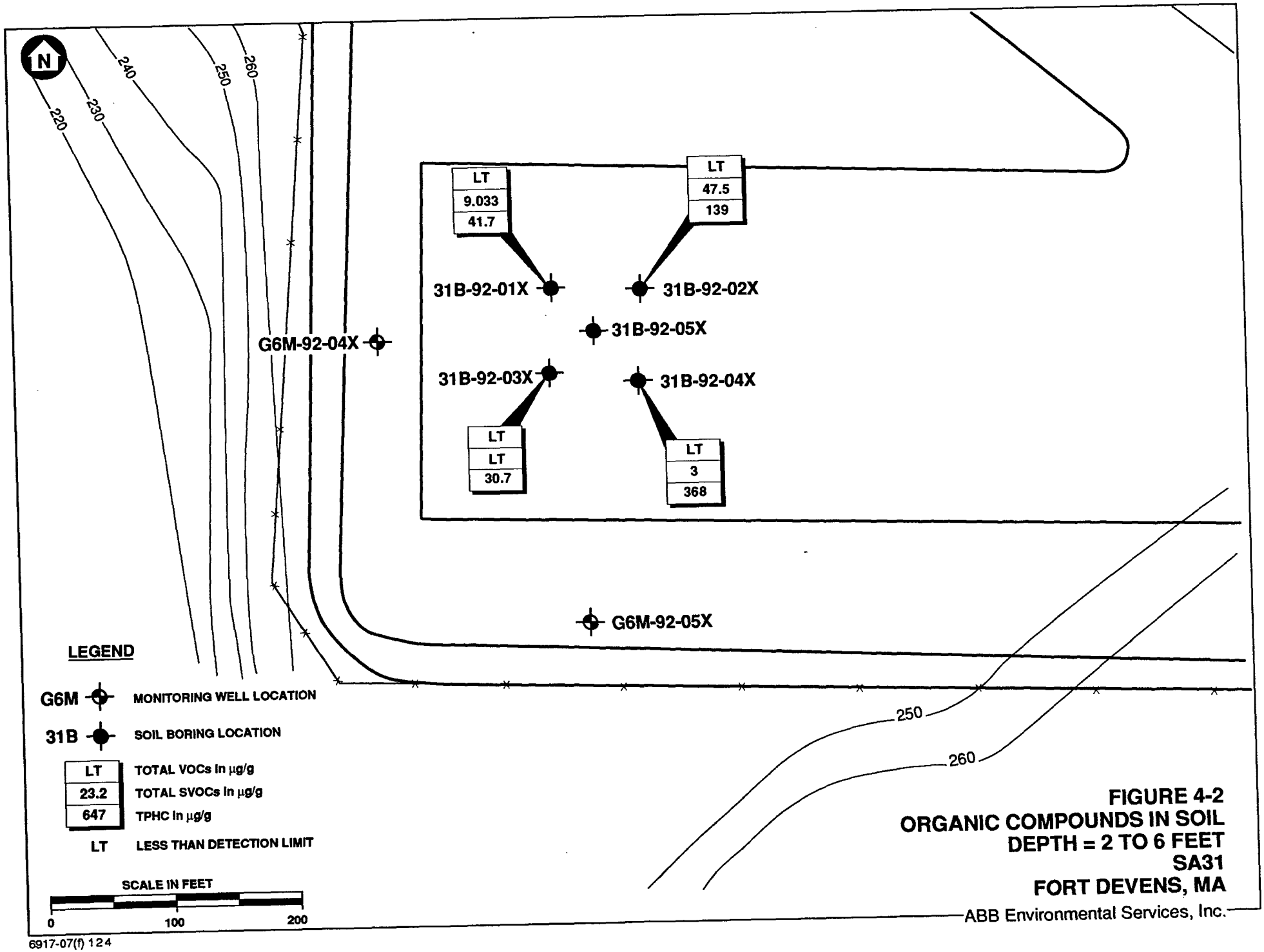

FIGURE 4-2
ORGANIC COMPOUNDS IN SOIL
DEPTH = 2 TO 6 FEET
SA31
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(f) 124

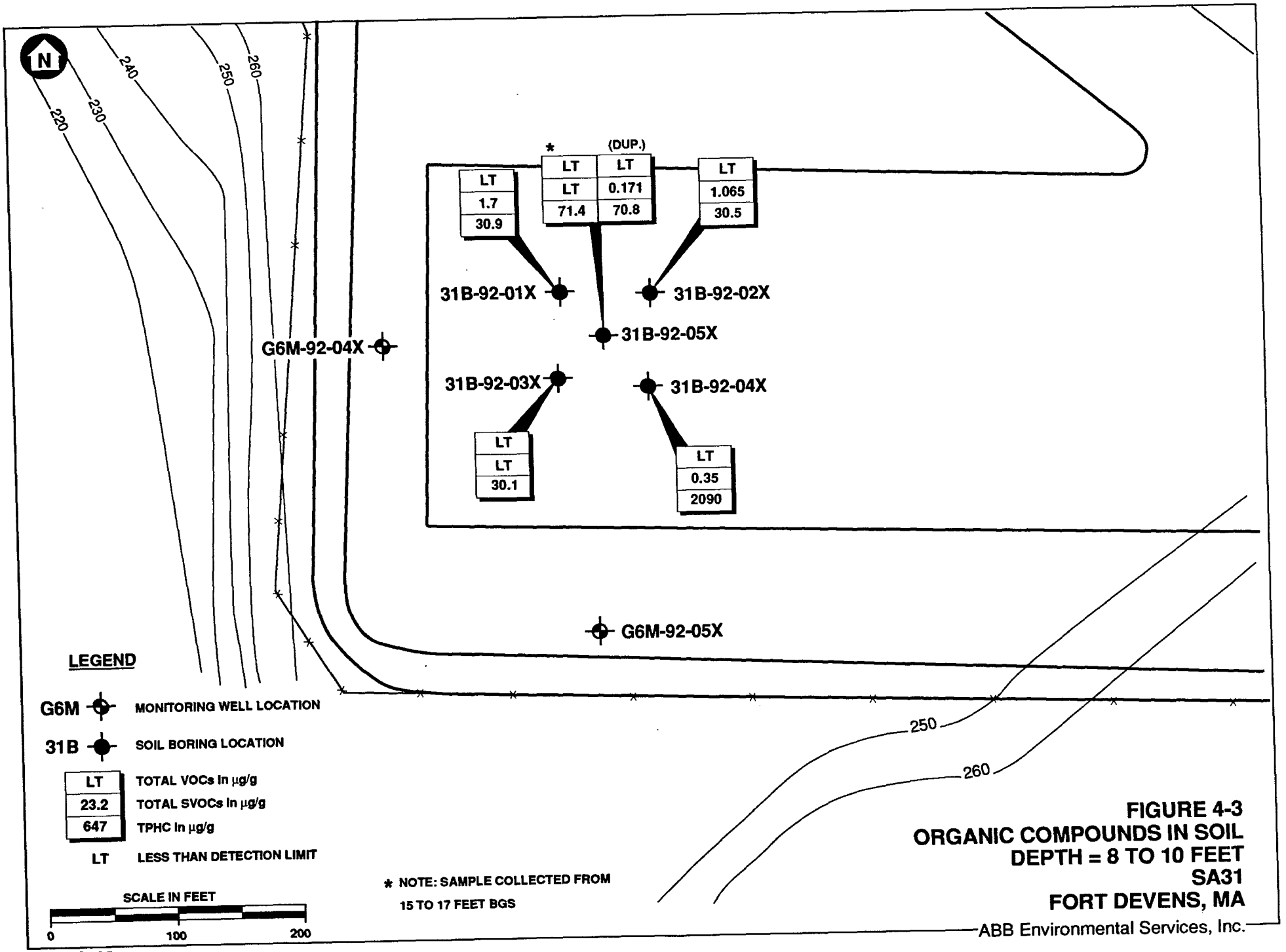

FIGURE 4-3
ORGANIC COMPOUNDS IN SOIL
DEPTH = 8 TO 10 FEET
SA31
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(f) 125

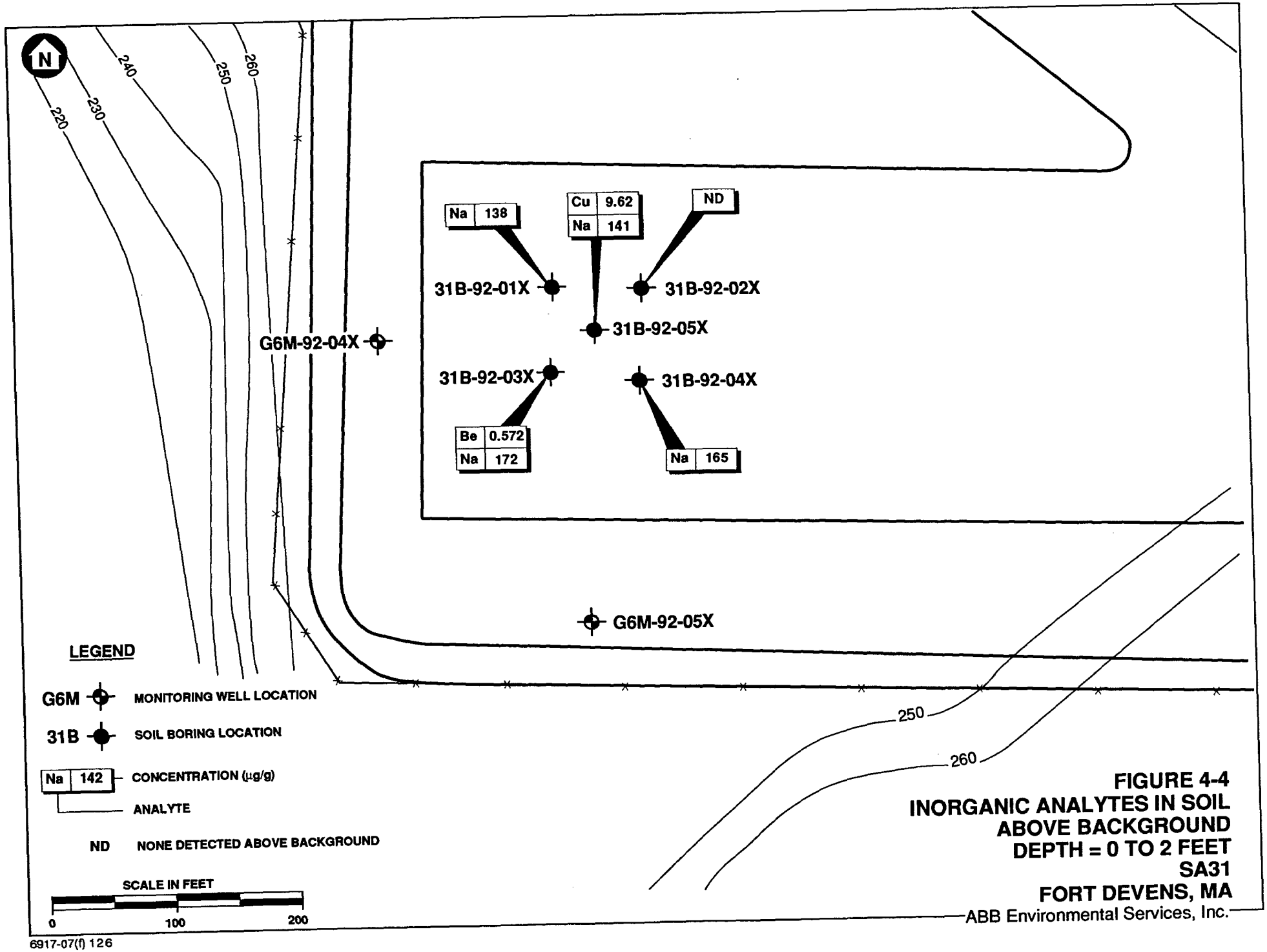

FIGURE 4-4
INORGANIC ANALYTES IN SOIL
ABOVE BACKGROUND
DEPTH = 0 TO 2 FEET
SA31
FORT DEVENS, MA
ABB Environmental Services, Inc.

6917-07(f) 126

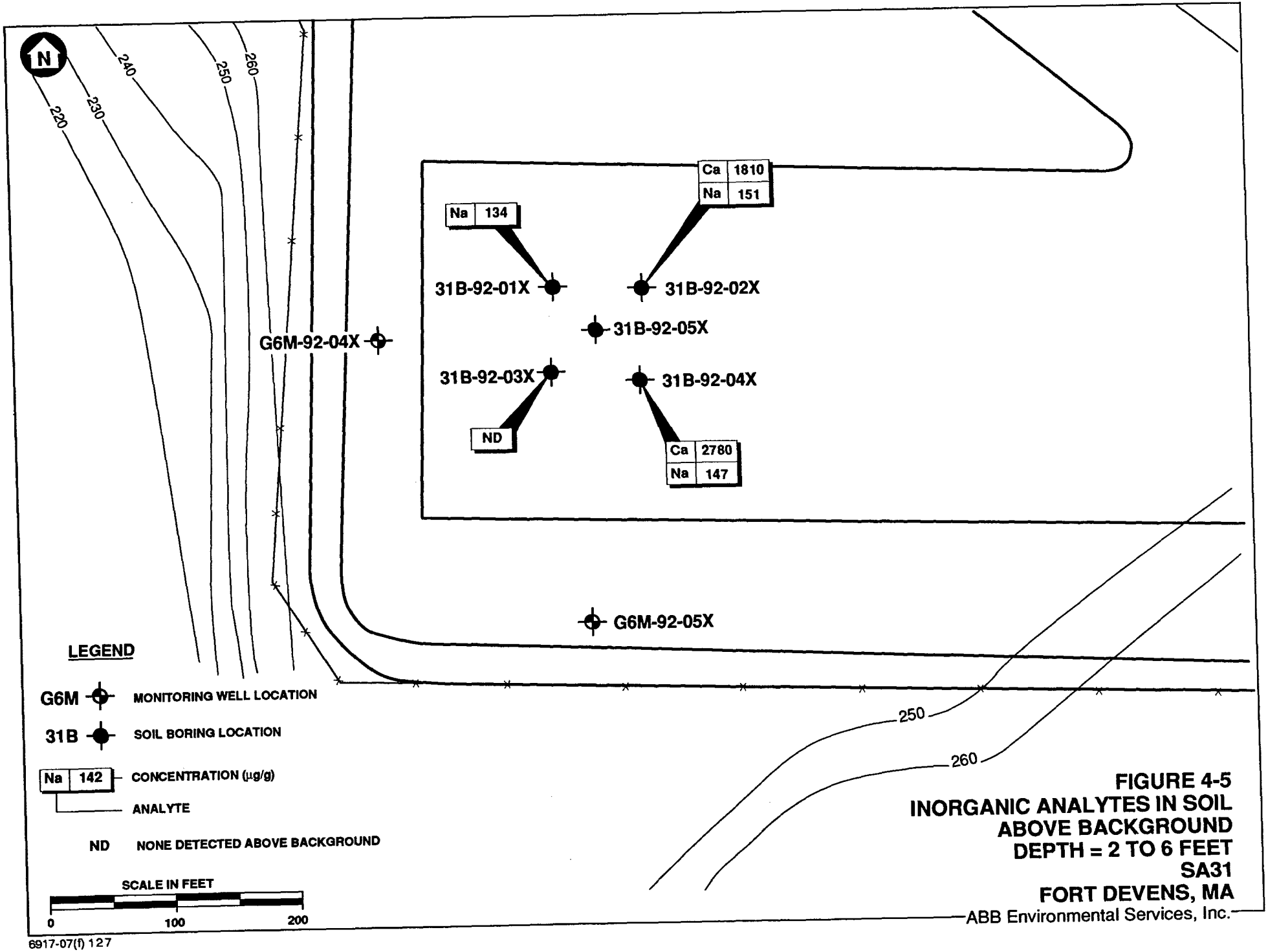

FIGURE 4-5
INORGANIC ANALYTES IN SOIL
ABOVE BACKGROUND
DEPTH = 2 TO 6 FEET
SA31
FORT DEVENS, MA
ABB Environmental Services, Inc.

6917-07(f) 127

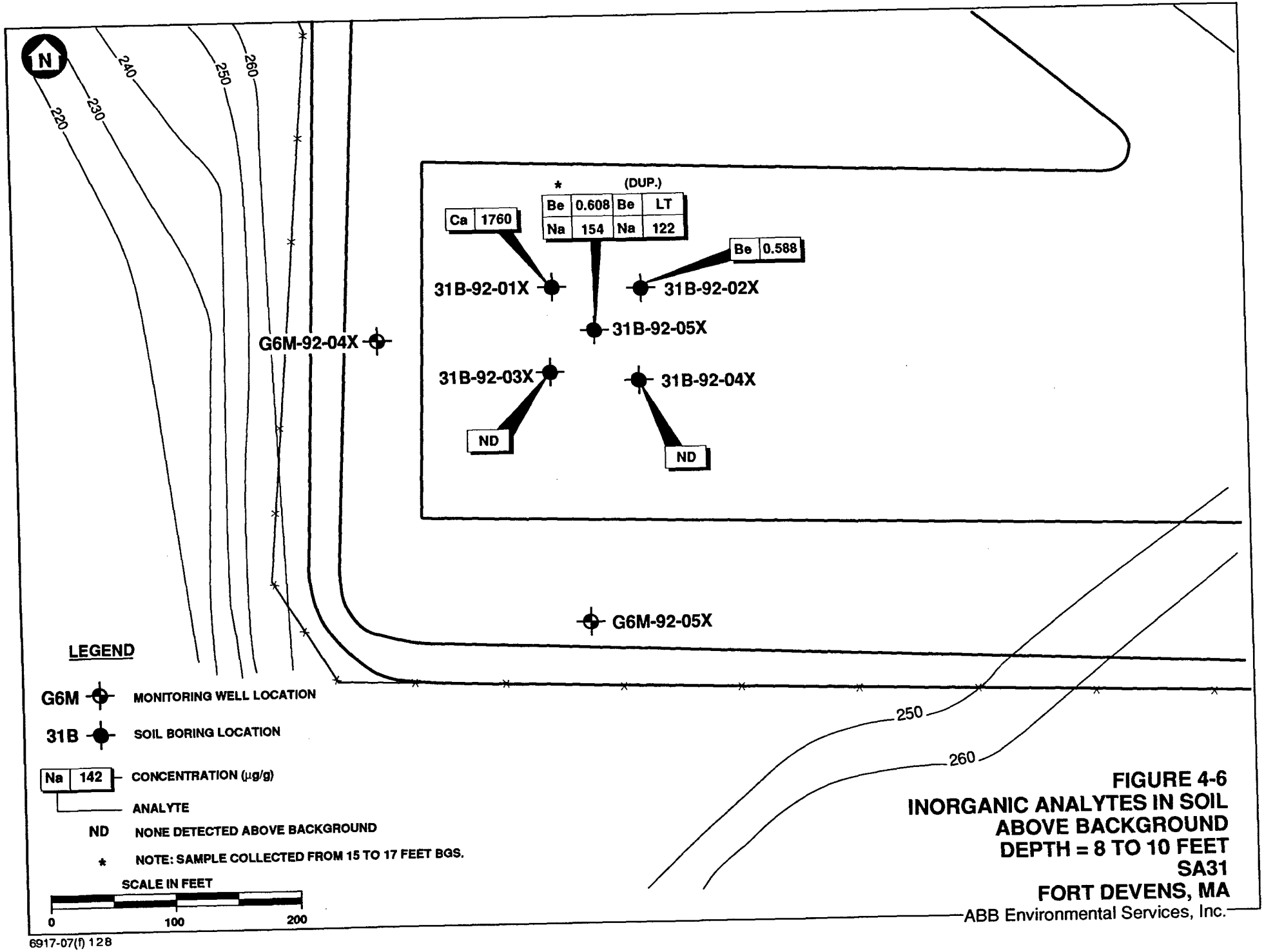

FIGURE 4-6
INORGANIC ANALYTES IN SOIL
ABOVE BACKGROUND
DEPTH = 8 TO 10 FEET
SA31
FORT DEVENS, MA
ABB Environmental Services, Inc.

6917-07(f) 128

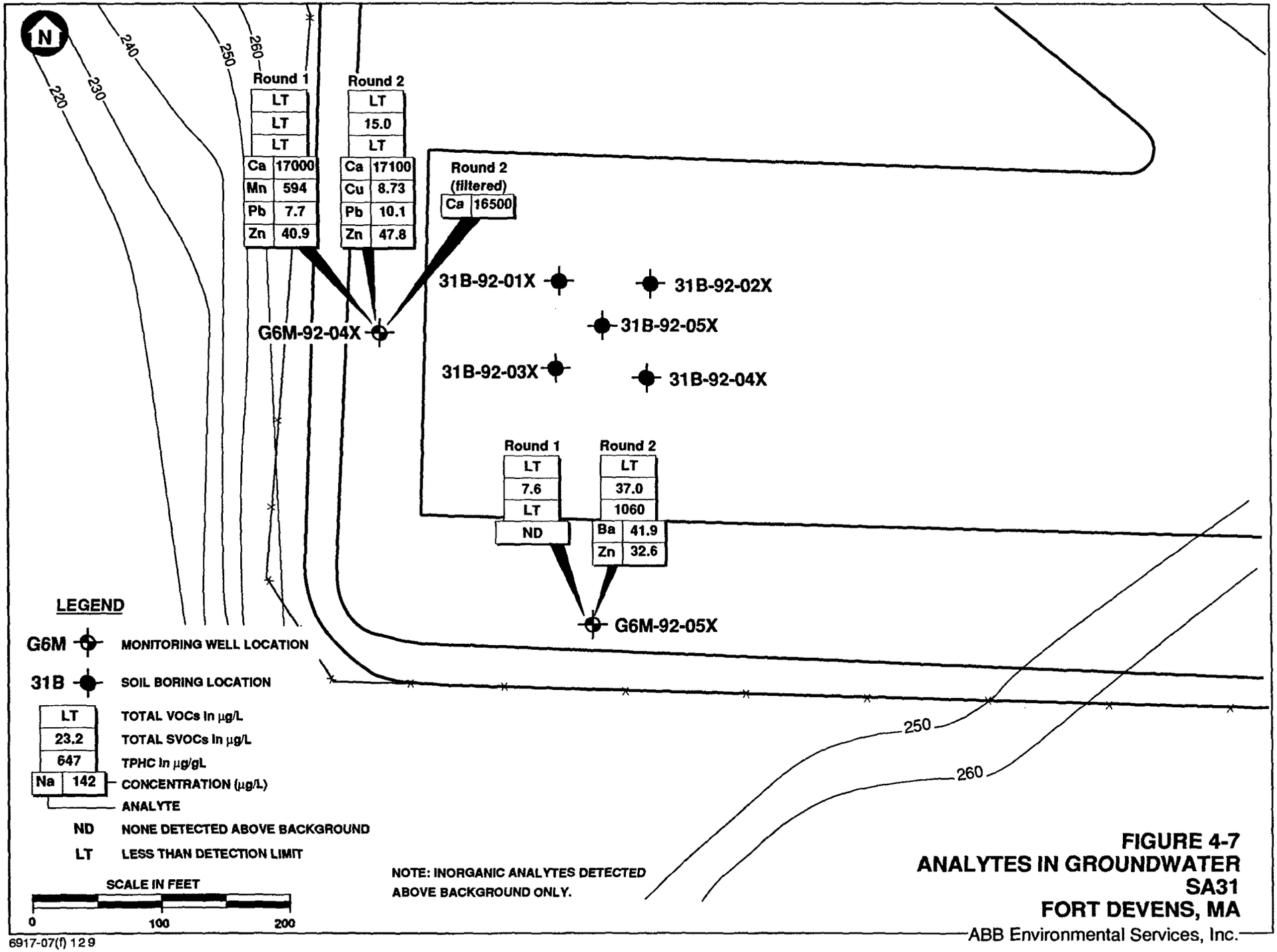

FIGURE 4-7
ANALYTES IN GROUNDWATER
SA31
FORT DEVENS, MA

ABB Environmental Services, Inc.

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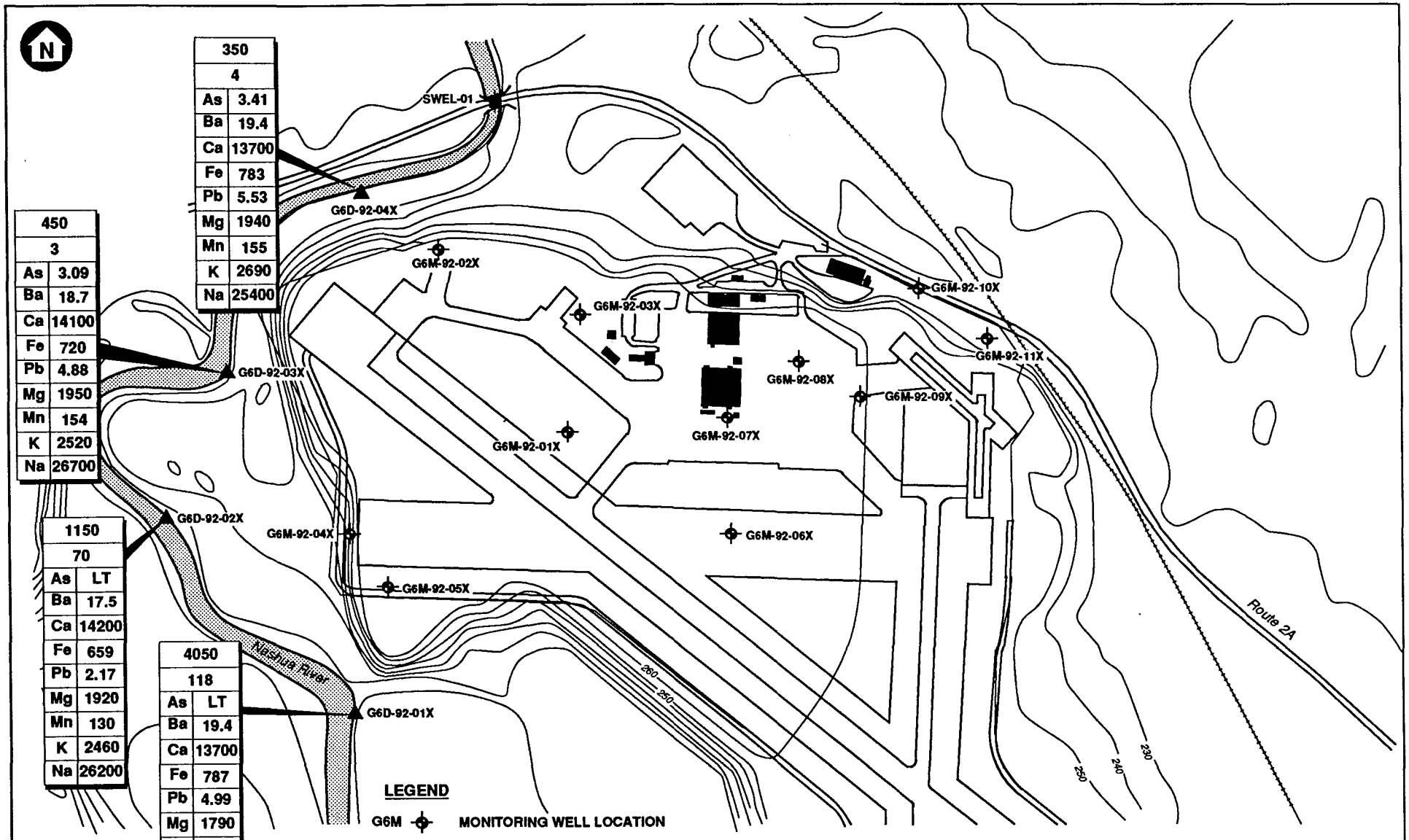

FIGURE 4-8
ANALYTES IN SURFACE WATER
GROUP 6 STUDY AREAS
FORT DEVENS, MA

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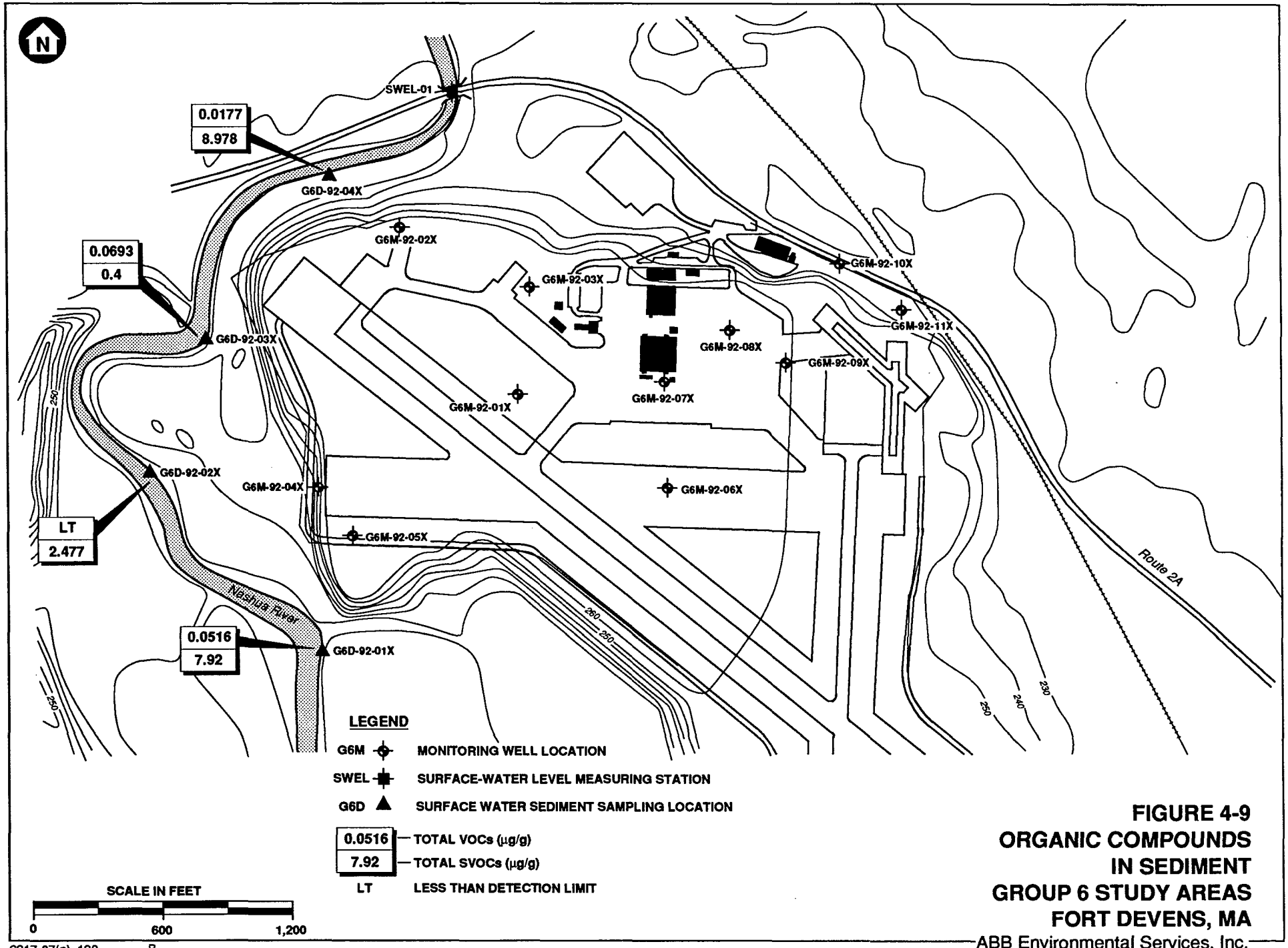

FIGURE 4-9
ORGANIC COMPOUNDS
IN SEDIMENT
GROUP 6 STUDY AREAS
FORT DEVENS, MA

ABB Environmental Services, Inc.

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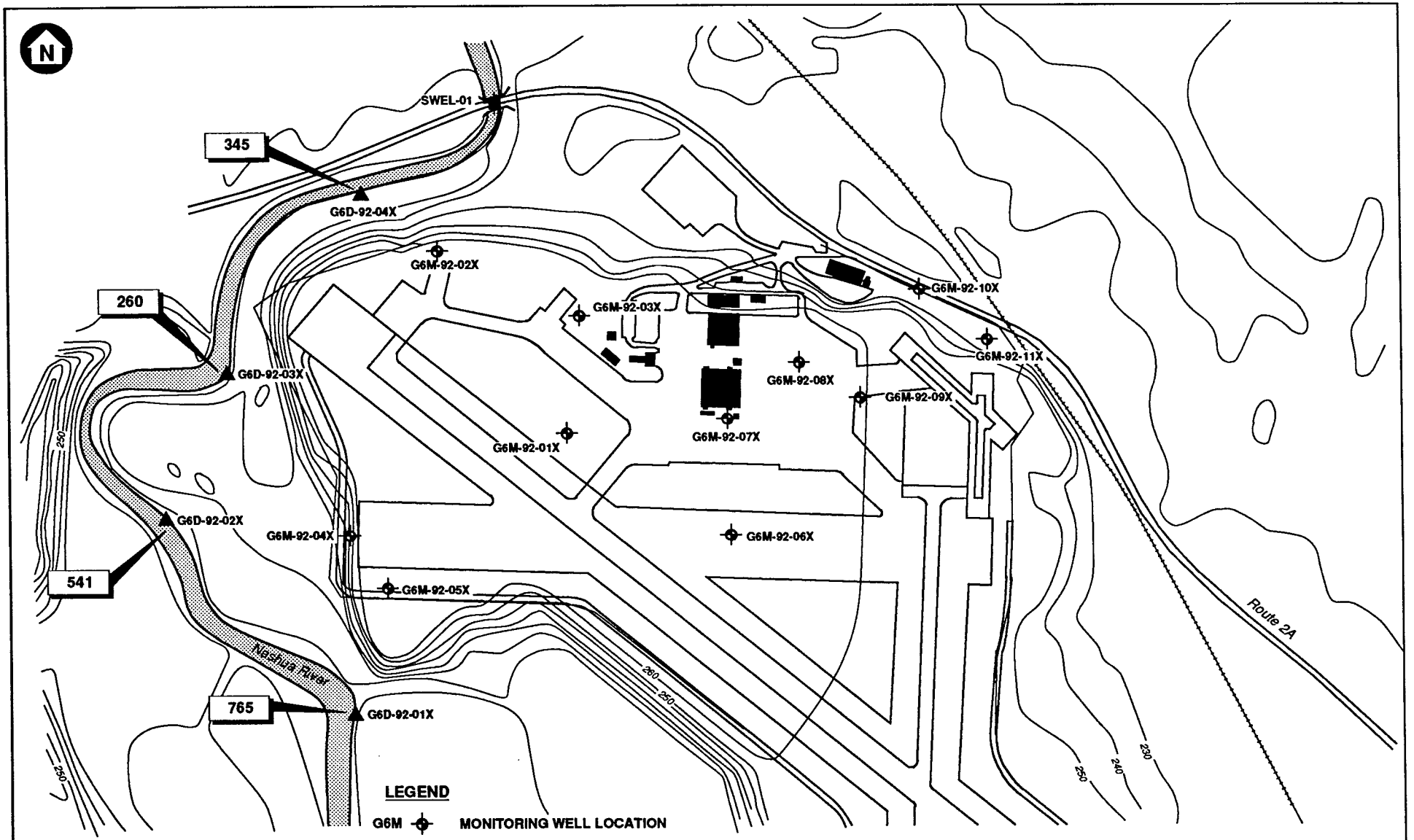

FIGURE 4-10
TOTAL PETROLEUM HYDROCARBON COMPOUNDS IN SEDIMENT
GROUP 6 STUDY AREAS
FORT DEVENS, MA

ABB Environmental Services, Inc.

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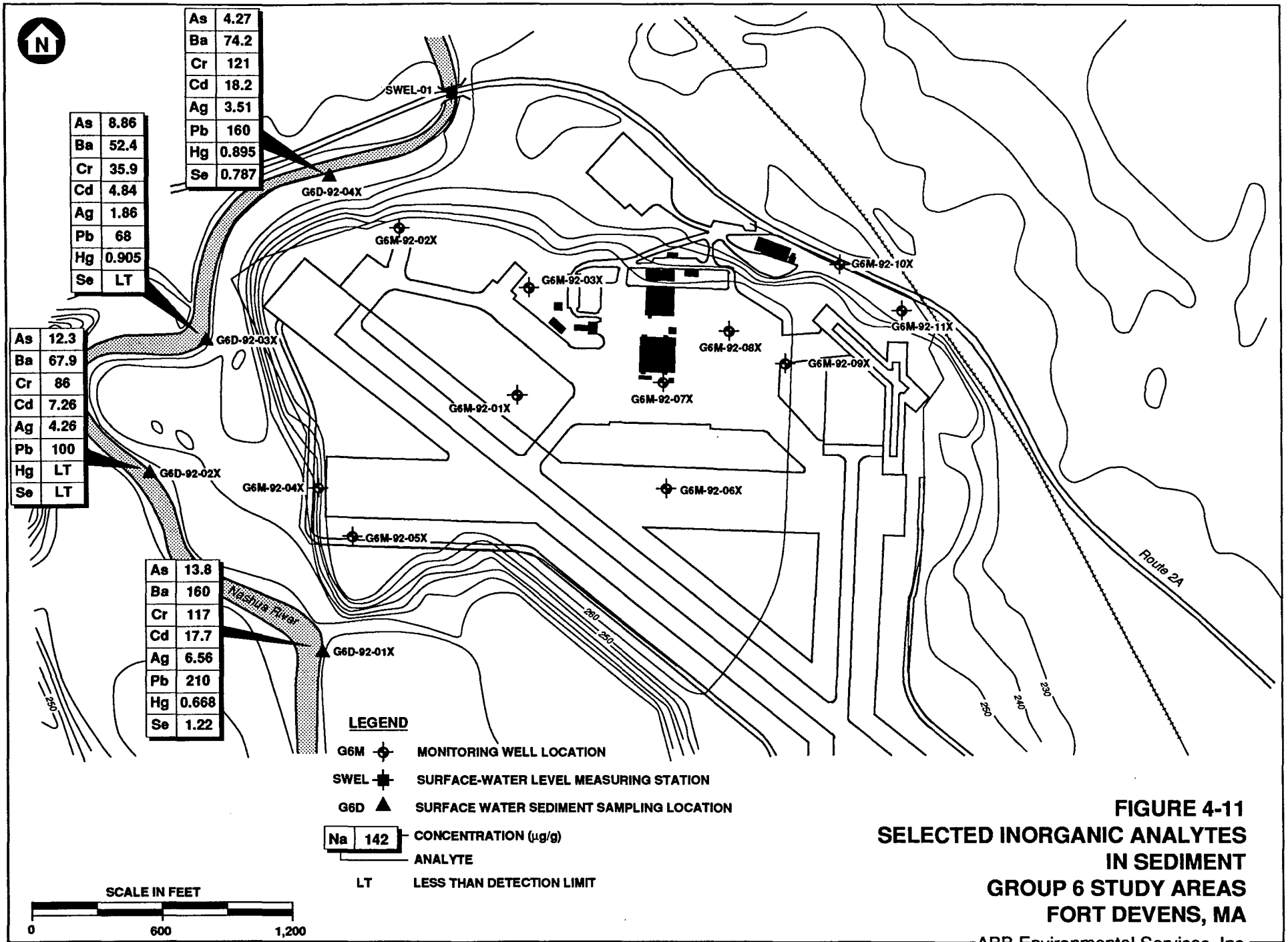

FIGURE 4-11
SELECTED INORGANIC ANALYTES IN SEDIMENT
GROUP 6 STUDY AREAS
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(a)-123 9

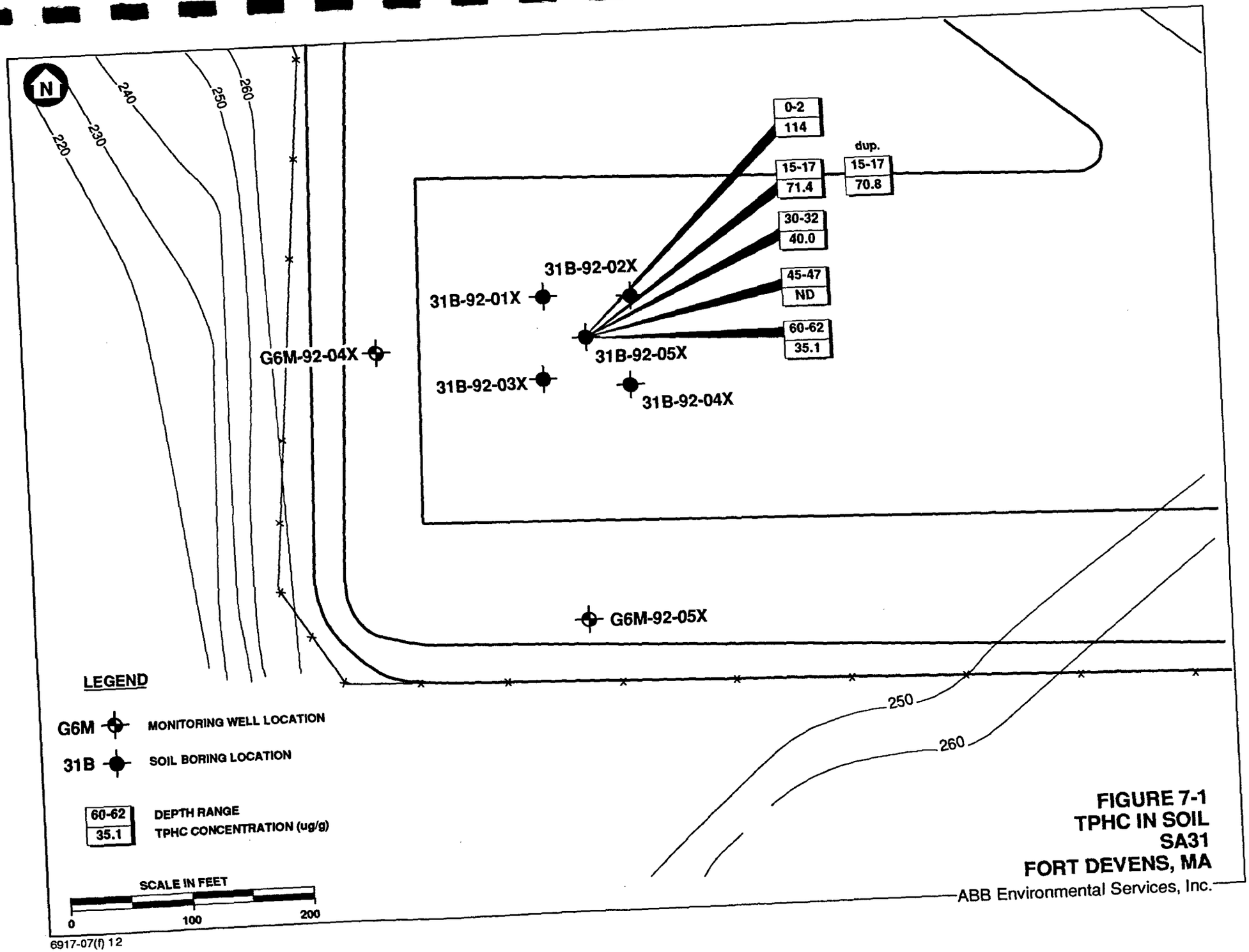

FIGURE 7-1
TPHC IN SOIL
SA31
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(f) 12

TABLE 4-1
ORGANIC COMPOUNDS IN SOIL
SA 31 – MOORE ARMY AIRFIELD FIRE-FIGHTING TRAINING AREA

FORT DEVENS

ANALYTE	BORING	31B-92-01X			31B-92-02X			31B-92-03X			31B-92-04X			31B-92-05X					
	DEPTH	0	2	8	0	4	8	0	4	8	0	4	8	0	15	15D	30	45	60
VOLATILES (ug/g)																			
TOLUENE		<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	0.0019	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078	<0.00078
SEMIVOLATILES (ug/g)																			
ANTHRACENE		<0.033	0.200	<0.200	<0.200	1.00	0.054	<0.033	<0.033	<0.033	0.600	<0.300	<0.033	0.048	<0.200	<0.033	<0.033	<0.033	<0.033
BENZO[A]ANTHRACENE		<0.170	0.550	<0.800	<0.800	3.00	<0.170	<0.170	<0.170	<0.170	<2.00	<2.00	<0.170	0.170	<0.800	<0.170	<0.170	<0.170	<0.170
BENZO[A]PYRENE		<0.250	0.620	<1.00	<1.00	<2.00	<0.250	<0.250	<0.250	<0.250	<2.00	<2.00	<0.250	0.320	<1.00	<0.250	<0.250	<0.250	<0.250
BENZO[B]FLUORANTHENE		<0.210	0.660	<1.00	<1.00	4.00	<0.210	<0.210	<0.210	<0.210	<2.00	<2.00	<0.210	0.560	<1.00	<0.210	<0.210	<0.210	<0.210
BENZO[G,H,I]PERYLENE		<0.250	0.360	<1.00	<1.00	<2.00	<0.250	<0.250	<0.250	<0.250	<2.00	<2.00	<0.250	0.300	<1.00	<0.250	<0.250	<0.250	<0.250
BENZO[K]FLUORANTHENE		<0.066	0.530	<0.300	<0.300	2.00	<0.066	<0.066	<0.066	<0.066	0.900	<0.700	<0.066	0.290	<0.300	<0.066	<0.066	<0.066	<0.066
CARBAZOLE		ND 0.033	0.180	ND 0.200	ND 0.200	1.00	ND 0.033	ND 0.033	ND 0.033	ND 0.033	0.700	ND 0.300	ND 0.033	ND 0.033	ND 0.200	ND 0.033	ND 0.033	ND 0.033	ND 0.033
CHRYSENE		<0.120	0.750	<0.600	<0.600	4.00	<0.120	<0.120	<0.120	<0.120	3.00	<1.00	<0.120	0.360	<0.600	<0.120	<0.120	<0.120	<0.120
DIBENZOFURAN		<0.035	0.073	<0.200	<0.200	1.00	<0.035	<0.035	<0.035	<0.035	<0.40	<0.400	<0.035	<0.035	<0.200	<0.035	<0.035	<0.035	<0.035
FLUORANTHENE		0.150	2.00	0.600	0.600	10.0	0.370	<0.068	<0.068	<0.068	6.00	1.00	0.130	0.460	<0.300	0.097	<0.068	<0.068	<0.068
FLUORENE		<0.033	0.150	<0.200	<0.200	3.00	0.061	<0.033	<0.033	<0.033	0.70	<0.300	<0.033	<0.033	<0.200	<0.033	<0.033	<0.033	<0.033
INDENO[1,2,3-C,D]PYRENE		<0.290	0.360	<1.00	<1.00	<3.00	<0.290	<0.290	<0.290	<0.290	<3.00	<3.00	<0.290	<0.290	<1.00	<0.290	<0.290	<0.290	<0.290
NAPHTHALENE		<0.037	<0.037	<0.200	<0.200	0.500	<0.037	<0.037	<0.037	<0.037	1.00	<0.400	<0.037	<0.037	<0.200	<0.037	<0.037	<0.037	<0.037
PHENANTHRENE		0.047	1.10	0.500	1.00	10.0	0.310	<0.033	<0.033	<0.033	5.00	1.00	0.120	0.220	<0.200	<0.033	<0.033	<0.033	<0.033
PYRENE		0.100	1.50	0.600	0.600	8.00	0.270	<0.033	<0.033	<0.033	4.00	1.00	0.100	0.380	<0.200	0.074	<0.033	<0.033	<0.033
OTHER (ug/g)																			
TPHC		34.5	41.7	30.9	30.5	139	30.5	83.1	30.7	30.1	156	368	2090	114	71.4	70.8	40.0	<28.5	35.1

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST FOR SUMMARY
ND = NOT DETECTED

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01/13/95

TABLE 4-2
INORGANIC ANALYTES IN SOIL
SA 31 – MOORE ARMY AIRFIELD FIRE-FIGHTING TRAINING AREA

FORT DEVENS

ANALYTE	BACK-	BORING	31B-92-01X			31B-92-02X			31B-92-03X			31B-92-04X			31B-92-05X					
(ug/g)	GROUND	DEPTH	0	2	8	0	4	8	0	4	8	0	4	8	0	15	15D	30	45	60
ALUMINUM	15000		5430	7180	2630	4780	6940	3290	6470	5650	2820	4220	5240	3070	4920	4370	2930	1980	2090	1920
ARSENIC	21		6.36	7.03	7.31	5.90	8.84	9.26	7.00	10.3	7.02	6.85	7.04	6.28	8.79	7.68	6.66	8.74	5.17	9.10
BARIUM	42.5		20.1	16.9	16.1	14.9	21.4	15.9	17.7	13.4	12.9	15.3	22.9	12.8	16.4	20.1	13.1	13.1	13.4	12.7
BERYLLIUM	0.347		<0.500	<0.500	<0.500	<0.500	<0.500	0.588	0.572	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	0.608	<0.500	<0.500	<0.500	<0.500
CALCIUM	1400		951	676	1760	624	1810	350	567	374	326	846	2780	464	1210	735	626	434	389	530
CHROMIUM	31		6.69	8.78	6.01	7.06	10.6	8.66	7.41	8.18	5.21	6.73	7.50	6.29	10.2	18.8	7.88	6.88	6.00	4.82
COBALT	NA		<1.42	2.05	1.88	<1.42	2.55	2.66	2.34	2.59	3.28	2.39	1.99	2.26	2.48	3.66	2.98	2.34	2.38	2.24
COPPER	8.39		3.92	4.37	3.81	4.60	5.57	4.28	4.19	5.06	7.11	4.56	4.28	4.70	9.62	6.70	5.73	4.07	5.52	4.00
IRON	15000		4120	5230	3580	4670	6470	4710	5320	4980	4320	4040	4490	4100	5530	6570	4470	3650	4350	3710
LEAD	48.4		5.22	7.39	7.58	7.46	5.38	3.36	7.22	4.41	2.40	4.17	4.46	2.85	8.08	4.59	5.58	2.97	3.56	2.90
MAGNESIUM	5600		754	883	790	899	1600	1410	1010	1020	977	898	1070	980	1220	2050	964	886	966	760
MANGANESE	300		63.1	61.9	69.6	78.0	97.6	86.9	72.1	61.8	92.0	60.9	61.8	75.0	65.2	126	99.6	87.2	91.7	76.8
MERCURY	0.22		0.08	0.118	<0.050	0.14	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
NICKEL	14.0		4.63	6.69	5.04	4.14	8.42	7.10	5.45	6.97	6.00	5.53	5.48	5.78	6.98	12.0	5.52	5.38	6.52	5.23
POTASSIUM	1700		237	300	388	385	560	649	462	306	536	421	437	453	425	850	444	440	444	413
SODIUM	131		138	134	130	125	151	120	172	117	116	165	147	126	141	154	122	144	112	126
VANADIUM	28.7		5.47	6.82	3.94	5.46	8.89	6.62	6.81	5.87	5.05	4.95	6.39	4.78	6.77	8.72	4.32	4.19	4.12	<3.39
ZINC	35.5		14.7	19.7	11.2	17.3	16.2	12.5	17.8	14.0	12.6	13.2	12.5	19.9	24.6	26.5	15.3	11.6	13.2	11.2

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST FOR SUMMARY
NA = NOT ANALYZED
[ ] = ABOVE BACKGROUND CONCENTRATION

I31BORE.WK1
01/17/94

TABLE 4-3
ANALYTES IN GROUNDWATER - ROUND 1 (July 1992)
GROUP 6 GROUNDWATER MONITORING WELLS

FORT DEVENS

ANALYTE	BACK-GROUND	G6M-92-01X	G6M-92-02X	G6M-92-03X	G6M-92-04X	G6M-92-05X	G6M-92-06X	G6M-92-07X	G6M-92-08X	G6M-92-09X	G6M-92-10X	G6M-92-11X
ORGANICS (ug/L)												
ACETONE		21.0	<13.0	<13.0	<13.0	<13.0	<13.0	<13.0	<13.0	<13.0	<13.0	<13.0
BIS(2-ETHYLHEXYL)PHTHALATE		<4.80	<4.80	<4.80	<4.80	7.60	8.80	<4.80	<4.80	<4.80	<4.80	<4.80
TPHC		1550	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
INORGANICS (ug/L)												
ALUMINUM	6870	1290	<141	150	2590	<141	<141	<141	178	230	850	1920
ARSENIC	10.5	<2.54	<2.54	<2.54	5.44	<2.54	<2.54	<2.54	<2.54	<2.54	<2.54	<2.54
BARIUM	39.6	14.9	<5.00	10.3	14.5	<5.00	<5.00	<5.00	9.18	7.60	153	16.1
CALCIUM	14700	10400	4520	12500	17000	4020	7240	16200	13100	18200	47100	5940
CHROMIUM	14.7	11.8	<6.02	<6.02	6.88	<6.02	<6.02	<6.02	<6.02	<6.02	<6.02	6.36
IRON	9100	1890	96.3	240	3580	102	53.4	132	208	332	816	2390
LEAD	4.25	<1.26	<1.26	<1.26	7.70	<1.26	<1.26	<1.26	<1.26	<1.26	1.52	2.28
MAGNESIUM	3480	1050	<500	1340	1650	512	688	1350	738	1600	2430	855
MANGANESE	291	66.8	18.5	42.5	594	37.4	7.64	9.80	31.9	22.7	309	99.0
POTASSIUM	2370	2340	2260	1820	1930	1040	1210	<375	1280	1990	5570	645
SILVER	4.60	93.6	<4.60	<4.60	<4.60	<4.60	<4.60	<4.60	<4.60	<4.60	<4.60	<4.60
SODIUM	10800	4020	3120	19300	3310	2540	5860	5590	2180	2000	300000	2420
ZINC	21.1	<21.1	<21.1	<21.1	40.9	<21.1	<21.1	<21.1	<21.1	<21.1	<21.1	<21.1
ANIONS/CATIONS (ug/L)												
BICARBONATE		<5000	12200	14600	34200	9760	24400	23200	51200	127000	8540	28100
CHLORIDE		<2120	<2120	29700	<2121	<2120	<2120	4130	<2120	<2120	200000	3480
SULFATE		<10000	<10000	15400	17900	<10000	12100	14100	<10000	24700	47000	<10000
NITRATE/NITRITE		7400	2000	3800	2000	380	850	5500	550	2400	1400	78.5
ALKALINITY		<5000	10000	12000	28000	8000	20000	19000	42000	104000	7000	23000
OTHER (ug/L)												
TSS		21000	13000	5000	84000	4000	6000	5000	13000	37000	40000	53000

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST FOR SUMMARY
[ ] = ABOVE BACKGROUND CONCENTRATION

G6WELLS1.WK1
01/17/94

TABLE 4-4
ANALYTES IN GROUNDWATER – ROUNDS 2 & 3 (Oct 1992/Jan 1993)
GROUP 6 GROUNDWATER MONITORING WELLS

FORT DEVENS

ANALYTE	BACK-GROUND	G6M-92-01X	G6M-92-02X	G6M-92-03X	G6M-92-04X	G6M-92-04X filt	G6M-92-05X	G6M-92-06X	G6M-92-07X	G6M-92-07X dup	G6M-92-08X	G6M-92-09X	G6M-92-10X	G6M-92-10X filt	G6M-92-11X	G6M-92-11X filt
ORGANICS (ug/L)																
BIS(2-E,H)PHTHALATE		20.0	33.0	17.0	15.0	NA	37.0	< 4.80	< 4.80	20.0	< 4.80	15.0	< 4.8	NA	18.0	NA
TPHC		< 192	< 193	< 182	< 182	NA	1060	218	<188	< 184	< 195	< 188	< 177	NA	< 192	NA
INORGANICS (ug/L)																
ALUMINUM	6870	387	250	1620	2300	< 141	331	1460	248	291	315	1120	2340	264	148	< 141
ARSENIC	10.5	< 2.54	< 2.54	4.05	10.0	< 2.54	< 2.54	8.21	< 2.54	< 2.54	< 2.54	< 2.54	2.98	< 2.54	< 2.54	< 2.54
BARIUM	39.6	6.82	75.7	53.6	38.7	14.7	41.9	31.7	16.2	< 5.00	13.4	37.7	208	146	59.7	25.4
CALCIUM	14700	7910	3380	9550	17100	16500	4460	8990	17000	18800	8110	13400	47500	47000	12600	11400
CHROMIUM	14.7	< 6.02	< 6.02	< 6.02	< 6.02	< 6.02	< 6.02	9.88	< 6.02	< 6.02	< 6.02	< 6.02	7.44	< 6.02	< 6.02	< 6.02
COPPER	8.09	< 8.09	< 8.09	< 8.09	8.73	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09	< 8.09
IRON	9100	535	291	2380	3260	< 38.8	1020	2320	393	451	341	1430	2600	< 38.8	205	58.7
LEAD	4.25	< 1.26	3.36	< 1.26	10.1	< 1.26	2.17	4.01	1.63	< 1.26	1.41	4.56	2.06	< 1.26	1.52	6.51
MAGNESIUM	3480	825	500	1300	1530	1090	626	1030	1410	1550	766	1420	2820	2350	766	671
MANGANESE	291	22.5	22.7	75.9	592	20.2	25.0	102	15.6	16.7	29.6	37.4	263	216	99.6	97.1
POTASSIUM	2370	2290	2690	2510	2020	1520	1510	1920	1420	1510	1930	2410	5940	5380	1710	1360
SODIUM	10800	3230	2750	21800	3000	1360	3100	5000	4410	5140	1930	2140	1200000	1200000	5560	4380
ZINC	21.1	59.3	50.1	36.5	47.8	< 21.1	32.6	30.1	29.5	33.8	25.6	42.9	41.2	39.6	22.9	< 21.1
ANIONS/CATIONS (ug/L)																
BICRABONATE		6000	6000	13000	34000	NA	12000	22000	24000	23000	26000	24000	9000	NA	12000	NA
CHLORIDE		< 2120	< 2120	31200	< 2120	NA	< 2120	< 2120	< 2120	< 2120	< 2120	< 2120	2100000	NA	15800	NA
SULFATE		< 10000	< 10000	13300	16700	NA	< 10000	11700	13500	13300	< 10000	16600	50300	NA	< 10000	NA
NITRATE/NITRITE		4400	1800	3300	2400	NA	730	990	8000	7000	620	1800	1400	NA	97.7	NA
ALKALINITY		5000	5000	11000	28000	NA	10000	18000	20000	19000	21000	20000	7000	NA	10000	NA
OTHER (ug/L)																
TSS		245000	34000	47000	170000	NA	17000	21000	15000	48000	23000	111000	72000	NA	16000	NA

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST FOR SUMMARY
NA = NOT ANALYZED
[ ] = ABOVE BACKGROUND CONCENTRATION

G6WELLS2.WK1
01/17/94

TABLE 4-5
ANALYTES IN GROUP 6 SURFACE WATER
NASHUA RIVER

FORT DEVENS

ANALYTE	G6D-92-01X	G6D-92-02X	G6D-92-03X	G6D-92-04X
INORGANICS (ug/L)				
ARSENIC	<2.54	<2.54	3.09	3.41
BARIUM	19.4	17.5	18.7	19.4
CALCIUM	13700	14200	14100	13700
IRON	787	659	720	783
LEAD	4.99	2.17	4.88	5.53
MAGNESIUM	1790	1920	1950	1940
MANGANESE	104	130	154	155
POTASSIUM	2640	2460	2520	2690
SODIUM	32200	26200	26700	25400
ANIONS/CATIONS (ug/L)				
CHLORIDE	60000	46000	47000	46000
SULFATE	14100	11600	14100	14000
NITRATE/NITRITE	1000	1000	980	1000
KJELDAHL NITROGEN	952	657	810	819
TOTAL PHOSPHOROUS	139	119	148	139
ALKALINITY	37000	23000	35000	31000
OTHER (ug/L)				
HARDNESS	46600	41000	45600	45800
TSS	7000	<4000	6000	6000
TOTAL COLIFORM (org/100ml)	4050	1150	450	350
FECAL COLIFORM (org/100ml)	118	70	3	4

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST FOR SUMMARY

G6SURF.WK1
01/17/94

TABLE 4-6
ANALYTES IN GROUP 6 SEDIMENTS
NASHUA RIVER

FORT DEVENS

ANALYTE	G6D-92-01X	G6D-92-02X	G6D-92-03X	G6D-92-04X
INORGANICS (ug/g)				
ALUMINUM	12200	7820	7290	6800
ANTIMONY	11.4	4.38	3.64	13.5
ARSENIC	13.8	12.3	8.86	4.27
BARIUM	160	67.9	52.4	74.2
BERYLLIUM	2.16	1.05	1.20	<0.500
CADMIUM	17.7	7.26	4.84	18.2
CALCIUM	1880	1880	1040	1050
CHROMIUM	117	86.0	35.9	121
COBALT	6.79	6.45	4.08	2.79
COPPER	128	74.7	43.7	100
IRON	17500	13100	10500	6600
LEAD	210	100	68.0	160
MAGNESIUM	3010	2140	2050	1710
MANGANESE	364	855	160	73.1
MERCURY	0.668	<0.050	0.905	0.895
NICKEL	22.3	13.8	15.5	12.5
POTASSIUM	1240	857	519	604
SELENIUM	1.22	<0.250	<0.250	0.787
SILVER	6.56	4.26	1.86	3.51
SODIUM	550	340	276	<100
VANADIUM	26.0	15.7	11.8	13.6
ZINC	284	115	106	121
ORGANICS (ug/g)				
ACETONE	<0.0170	<0.0170	0.0658	<0.0170
TOLUENE	0.0516	<0.00078	0.00353	0.0177
BIS(2-ETHYLHEXYL)PHTHALATE	<3.10	<3.10	<3.10	6.74
FLOURANTHENE	3.21	0.770	<0.340	0.856
PHENATHRENE	1.43	0.587	<0.165	0.508
PYRENE	3.28	1.12	0.400	0.874
OTHER (ug/g)				
TOTAL PETROLEUM HYDROCARBONS	765	541	260	345
TOTAL ORGANIC CARBON	31600	14300	9460	9880

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST FOR SUMMARY

G6SEDS.WK1
01/17/94

TABLE 5–1
HUMAN HEALTH PRE EVALUATION OF SURFACE SOIL
STUDY AREA 31 – MOORE ARMY AIRFIELD FIRE FIGHTING TRAINING AREA

FORT DEVENS

Analyte	Soil Background Concentration [a]	Detected Concentration [b]		Frequency Of Detection	Maximum Exceeds Background?	Region III Residential Soil Concentration (ug/g)	Maximum Exceeds Region III Concentration?
		Average	Maximum				
Inorganics (ug/g)							
aluminum	15,000	5,500	7,180	6/6	NO	230,000	NO
arsenic	21	7.0	8.8	6/6	NO	0.97	YES
barium	42.5	17	20	6/6	NO	5,500	NO
beryllium	0.347	0.57	0.57	1/6	YES	0.4	YES
chromium	31	7.8	10	6/6	NO	390	NO
cobalt	NA	2.3	2.5	4/6	NA	NA	NA
copper	8.39	5.2	9.6	6/6	YES	2,900	NO
lead	48.4	6.6	8.1	6/6	NO	500	NO
manganese	300	67	78	6/6	NO	7,800	NO
mercury	0.22	0.11	0.14	3/6	NO	23	NO
nickel	14.0	5.6	7.0	6/6	NO	1,600	NO
vanadium	28.7	6.0	6.8	6/6	NO	550	NO
zinc	35.5	18	25	6/6	NO	23,000	NO
Organics (ug/g)							
toluene		0.0019	0.0019	1/6	NA	16,000	NO
anthracene		0.28	0.6	3/6	NA	23,000	NO
benzo[a]anthracene		0.36	0.55	2/6	NA	1.6	NO
benzo[a]pyrene		0.47	0.62	2/6	NA	0.23	YES
benzo[b]fluoranthene		0.61	0.66	2/6	NA	1.9	NO
benzo[g,h,i]perylene		0.33	0.36	2/6	NA	11	NO
benzo[k]fluoranthene		0.57	0.9	3/6	NA	4.4	NO
carbazole		0.44	0.7	2/6	NA	85	NO
chrysene		1.4	3	3/6	NA	NA	NA
dibenzofuran		0.073	0.073	1/6	NA	NA	NA
fluoranthene		1.8	6	5/6	NA	3,100	NO
fluorene		0.43	0.7	2/6	NA	3,100	NO
indeno[1,2,3–c,d]pyrene		0.36	0.36	1/6	NA	0.84	NO
naphthalene		1	1	1/6	NA	3,100	NO
phenanthrene		1.5	5	5/6	NA	2,300	NO
pyrene		1.3	4	5/6	NA	2,300	NO
TPHC		77	156	6/6	NA	NA	NA

Notes:

[a] Base–wide background soil inorganic database

[b] Surface soil samples from sampling station 31B–92–01X to 31B–92–05X.

NA = not available.

TABLE 5–2
HUMAN HEALTH PRE EVALUATION OF SUBSURFACE SOIL
STUDY AREA 31 – MOORE ARMY AIRFIELD FIRE FIGHTLING TRAINING AREA

FORT DEVENS

Analyte	Soil Background Concentration [a]	Detected Concentration [b]		Frequency of Detection (out of 9)	Maximum Exceeds Background ?	Region III Commercial/Industrial Concentration (ug/g)	Maximum Exceeds Region III Concentration?
		Average	Maximum				
Inorganics (ug/g)							
aluminum	15,000	4,104	6,940	9	NO	3,000,000	NO
arsenic	21	7.8	10	9	NO	1.6	YES
barium	42.5	17	23	9	NO	72,000	NO
beryllium	0.347	0.60	0.61	2	YES	0.67	NO
chromium	31	8.8	19	9	NO	5,100	NO
cobalt	NA	2.7	3.7	9	NA	NA	NA
copper	8.39	5.2	7.1	9	NO	35,000	NO
lead	48.4	4.5	7.6	9	NO	500	NO
manganese	300.0	86	126	9	NO	100,000	NO
nickel	14.0	6.9	12	9	NO	20,000	NO
vanadium	28.7	6.1	8.9	9	NO	7,200	NO
zinc	35.5	16	27	9	NO	310,000	NO
Organics (ug/g)							
anthracene		0.53	1	2	NA	310,000	NO
benzo(a)anthracene		3	3	1	NA	2.7	YES
benzo(b)fluoranthene		4	4	1	NA	3.2	YES
benzo(k)fluoranthene		2	2	1	NA	7.4	NO
carbazole		1	1	1	NA	140	NO
chrysene		4	4	1	NA	NA	NA
dibenzofuran		1	1	1	NA	NA	NA
fluoranthene		2.0	10	6	NA	41,000	NO
fluorene		1.5	3	2	NA	41,000	NO
naphthalene		0.5	0.5	1	NA	41,000	NO
phenanthrene		2.4	10	5	NA	30,000	NO
pyrene		1.7	8	6	NA	31,000	NO
TPHC		318	2,090	9	NA	NA	NA

Notes:
[a] Base–wide background soil inorganics database.
[b] Subsurface soil samples from sampling stations 31B–92–01X to 31B–92–05X.
NA = not available.

TABLE 5-3
HUMAN HEALTH PRE EVALUATION OF GROUNDWATER
STUDY AREA 31 - MOORE ARMY AIRFIELD FIRE FIGHTING TRAINING AREA

FORT DEVENS

Analyte	Groundwater Background Concentration	Maximum Detected Concentration [a]	Maximum Exceeds Background?	Drinking Water Standard/Guideline [b] (ug/l)	Maximum Exceeds Standard/Guideline?
Organics (ug/l)					
bis(2-ethylhexyl)phthalate		37.0		6.1	YES
TPHC		1,060		NA	NA
Inorganics (ug/l)					
aluminum	6,870	2,590	NO	50-200	YES
arsenic	10.5	10.0	NO	50	NO
barium	39.6	41.9	YES	2,000	NO
calcium	14,700	17,100	YES	NA	NA
chromium	14.7	6.88	NO	100	NO
copper	8.09	8.73	YES	1,000	NO
iron	9,100	3,580	NO	300	YES
lead	4.25	10.1	YES	15	NO
magnesium	3,480	1,650	NO	NA	NA
manganese	291	594	YES	50	YES
potassium	2,370	2,020	NO	NA	NA
sodium	10,800	3,310	YES	28,400	NO
zinc	21.1	47.8	YES	5,000	NO
Anions/Cations (ug/l)					
nitrate/nitrite		2,400		10,000	NO

NOTES:
[a] Maximum from either Round 1 or Rounds 2 & 3. Only unfiltered samples are used for inorganics.
[b] Standard/Guideline selected in order of the following preference: MA drinking water standard, EPA drinking water standard, Region III Tap Water Concentration.
[c] SA 31 is represented by monitoring wells G6M-92-04X and G6M-92-05X.
ND Not detected
NA Not available